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Computer-Controlled Freeway Surveillance & Control System on the Queen Elizabeth Way

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PREFACE

The main purpose of this report is to describe the QEW control software. However, since the function of the control software is to respond to the real-time highway environment, and to activate and monitor the control hardware, the interfaces among hardware, software and highway environment are also described.

The manuscript of this report was completed in the summer of 1981. It reflected the information available at that time. The first printing was in April, 1983, and the current printing incorporates revisions to date as of December, 1983.

1/ INTRODUCTION

1.1/ System Definition and Objective

The principal goal of a freeway surveillance and control system (FSCS) is to maintain an acceptable level of traffic service on the freeway.. The advent of the computer-supervised freeway surveillance and control system adds a significant new dimension to the terms surveillance and control. Weinberg (1964) defined computer-supervised surveillance and control as:

> "A closed loop system .... that provides for surveillance of traffic operations which can be processed by a computational logic in a real-time computer, testing observed conditions against a set of decision rules, selecting commands in light of the results of the test, activating appropriate controls or communicating with drivers to improve traffic movement when necessary, and then reassessing the traffic behaviour to determine if further corrections are to be made."

Thus, a computerized freeway surveillance and control system provides optimal real-time management of freeway corridor traffic, particularly in providing the quantitative data required to effectively manage traffic bottlenecks and capacity-reducing incidents.

1.2/ System Scope

This section describes the expanded QEW FSCS system scope from the freeway, hardware, and software points of view.

Freeway: The freeway system includes Highway 403 (Ford Drive) interchange, Winston Churchill interchange, Southdown Road interchange, Mississauga Road interchange, Highway 10 interchange and Cawthra Road interchange. The controlled freeway section is approximately 16.64 km long. There are 22 mainline freeway speed sampling loop detector stations which are approximately 0.8 km apart. The function of the mainline detector station is to assess the level of service on the mainline freeway. Each interchange's on-ramp has queue, demand, and passage detectors installed to assess the on-ramp traffic during the morning rush-hour period. Each interchange off-ramp has an exit detector installed to determine the off-ramp traffic. Each on-ramp has a ramp controller and a signal light system installed to control traffic during the morning rush-hour period. Appendix 1 shows the freeway system scope.

Hardware: The hardware system includes the traffic control computer subsystem, the traffic data communication subsystem, the ramp controller and signal light subsystem, the traffic detector subsystem and the changeable message sign subsystem. The traffic control computer subsystem includes a NOVA 4/X central processing unit with 128K words of memory, a 10-million byte disk unit, a 9-track magnetic tape unit, a Dasher control console, a Tektronix colour graphic terminal, a Tektronix hardcopy unit, and a front-end traffic communication processor. The traffic data communication subsystem includes the HP 21MX mini-computer, with 32K byte memory, and a head-end master data modem, an ASR-33 TTY, twenty-five field data modems and two-way data channels provided by a two-way coaxial cable system. The ramp controller and signal light subsystem includes five CR710 ramp controllers, three type 170 ramp controllers, and the associated signal light equipment. The traffic detector subsystem includes 180 loop detectors. Appendix 2 shows the hardware system scope.

Software: The software system includes a mapped Real-Time Disk Operating System (MRDOS), traffic data acquisition subsystem, incident detection subsystem, ramp control subsystem, changeable message sign subsystem, freeway corridor status display subsystem, hardware monitoring subsystem, and system control command subsystem. The function of the QEW FSCS software is to effectively manage the preceding hardware system resources in responding to dynamic and changing freeway corridor traffic behaviour such that an acceptable level of service for the controlled freeway corridor can be obtained.

The "QEW" Program runs under the real-time multi-task environment provided by MRDOS. The software is written in real-time FORTRAN IV and NOVA assembly language.

2/ HARDWARE DESCRIPTION

2.1/ Overview

The expanded QEW FSCS project has 180 loop detectors, 8 ramp controllers, and 2 changeable message signs installed along 16.64 km of the eastbound QEW freeway section between Highway 403 interchange and Cawthra Road interchange. These traffic sensing and control devices are connected to 25 field data modems located inside the 25 field cabinets. Appendix 3 shows the control system configuration diagram for the expanded QEW FSCS project.

These 25 field data modems communicate with a head-end master data modem located in the traffic control centre through a duplex data channel provided by a two-way coaxial cable network.

In the traffic control centre, the head-end master data modem is connected to a communication processor (HP 21MX) which controls the time-division multiplexing traffic data network and communicates with the NOVA 4/X traffic control computer. An ASR33 TTY with paper tape punch and reader facility is also connected to the communication processor to monitor system hardware status. A Decitek high-speed paper tape reader and a flexible disk subsystem are used for loading communication processor system software. The traffic control computer communicates with the communication processor through a duplex DMA data channel. The traffic control computer also controls a system console (Dasher 6042), a colour graphics display terminal (Tektronix 4027) and an attached hardcopy unit, a disk drive (6045 disk cartridge), a magnetic tape drive (6027 800 BPI tape), and a four-line asynchronous multiplexer. Appendix 4 shows the control computer hardware block diagram.

2.2/ NOVA 4/X Traffic Control Computer

The Traffic Control Computer (TCC) is a Data General (DG) NOVA 4/X minicomputer. The NOVA 4/X uses 16-bit, single-word multi-function instructions. The central processor uses a single 15" PCB to implement all CPU functions with on-board asynchronous interface, real-time clock, auto program load. It has four-way interleaved, 256KB MOS memory with 400 nanosecond cycle time. An instruction prefetch processor looks ahead of currently executing operations to store further instructions in a high-speed first-in, first-out (FIFO) buffer. It has a memory management and protection unit which allows protected two-ground operation, protection for I/O devices, and both write and validity protection for main memory. A 16-slot chassis provides maximum configurability. A virtual console further enhances reliability by eliminating almost all mechanical switches. At power-up time, a diagnostic program tests the central processor, memory, and the prefetch processor. The I/O system has a 16-bit word length, low-speed programmed data transfer, a high-speed direct memory access data channel, a 16-level programmed priority interrupt, a 64-device addressing capability, and automatic interrupt source identification. It also has a power failure monitor and hardware multiply/divide capability. Appendix 5 shows the 16-slot chassis CPU configuration. Because most options are on the CPU board, and up to 256KB is available on a single memory board, the system has as many as 14 slots available for I/O controllers.

2.3/ Dasher 6042 Console

The Dasher 6042 Console is a fast, quiet unit for data input and output application. The 6042 has a standard 96-character, upper- and lower-case typewriter keyboard and provides both local and remote operation. It is interface compatible with teletype and other ASCII input devices. A 40-character buffer and a 60 cps catch-up printing capability give the 6042 printers true 30 cps throughput capability. When operating in the 30 cps mode, characters flow through the buffer and are printed at 30 cps, leaving the buffer empty. During carriage returns, the print head is disabled and characters accumulate in the FIFO buffer. When the carriage reaches full left position, the print head begins printing characters at 60 cps and continues in this catch-up mode until the buffer is empty. It then returns to 30 cps operation. The 6042 also has a user-selectable view mode. If no data are received for two seconds, the printing head automatically moves six spaces to the right, giving the user a clear view of the previously printed text. If the print head is within six spaces of its far right position, it automatically moves to the left. The print head moves back to its original position and begins printing when a character is received.

2.4/ Tektronix 4027 Colour Graphics Terminal

The Tektronix 4027 interactive graphics terminal has a 33 cm diagonal CRT display with 19.1 cm x 25.5 cm usable display area. It uses standard 525 master line scan with 480 lines displayed at 30 Hz scan rate. The display refresh rate is 30 times per second for the dot, 30 times per second for the frame, and 60 times per second for the field. The 4027 has a full ASCII keyboard with typewriter keys, terminal function control, programmable function keys, numeric pad, cursor control, scrolling, and crosshair cursor function. It has 80 characters per line and 34 lines per display with 2720 total characters per display. The character size is 7 x 9 in an 8 x 14 dot matrix. Each graphic cell (character position) is also an 8 x 14 dot matrix. The column of dots are numbered from left to right across the graphic region, starting with 0 for the left most column, and from bottom to top, starting with 0 for the bottom row. This establishes a coordinate system in the graphic region. For each dot in this region there is a pair of numbers: its X- and Y- coordinates. The potential number of dots is 640 horizontally and 476 vertically. Graphic input capability consists of a graphic crosshair cursor controlled by graphic cursor keys. In addition to reporting the coordinates back to the host computer, the 4027 also reports the colour of the designated coordinate. Since the location of the user-controlled crosshair can be read by the host computer along with the value of any key that is depressed, an interactive graphic dialogue can be established to edit or modify displayed data. Colours are selected from a 64 colour palette with up to eight colours displayed simultaneously on the screen. Features of the 4027 include colouring vectors, characters, symbols, and filling polygons. The firmware enables another colour to border the polygon.

The 4027's virtual bit map technique allows scrolling of colour alphanumerics and graphics on the screen. The 4027 has 32K bytes of display memory to hold and display text, forms, and graphics and has 192K bytes of graphics memory to cover 4088 graphic cells. The device has an RS232C interface to the NOVA 4/X host computer with selectable data transmission speed up to 9600 baud. The standard video signal output allows connection of the 4027 to external video displays for group viewing and presentations.

2.5/ Tektronix 4632 Hardcopy Unit

The 4632 video hardcopy unit is used to make grayscale presentation of the 4027 colour display. A paper copy is produced when the front panel "copy" push button is pressed, or a remote signal (from 4027) is applied. The 4632's dry-process development system uses 3M Brand Type 777 Dry-Silver paper for the high image quality required by complex graphics and alphanumerics. It produces dry 21.6 x 27.9 cm ($8^1/_2$ x 11 inch) copy of 4027 display in grayscale and allows clean, conventional paper handling -- one can write on it in pen or pencil and erase pencil marks without damage. The 4632 produces the first copy in about 18 s, and subsequent copies of the same display in about 8 s.

2.6/ Disk Unit

The model 6045 cartridge disk subsystem includes one disk drive, power supply, a controller, cartridges, and cable sets. Each disk drive contains a single spindle for one two-surface fixed 5-megabyte disk cartridge (DPOF),and one two-surface removeable 5-megabyte disk (DPO) cartridge. Each surface has a corresponding read/write head. The head positioning system provides fast radial positioning of the four heads to any one of the 408 cylinders. The average positioning time is 38 ms.

Track-to-track head positioning takes a maximum of 8 ms. Maximum full stroke positioning time is 70 ms. The disk drive operates at 2400 rpm with an average latency time of 12.5 ms and transfer data at 312 500 bytes per second. A special circuit monitors the temperature gradient between the cartridge and the driver after a new medium is loaded, and provides for a safe temperature differential before operation is begun.

This increases reliability and helps ensure data integrity. The disk drive requires 30 s to reach operating speed and 25 s to stop. The frequency requirement is 60 Hz ± 1 Hz and the power requirements are 120 VAC, 60 Hz and 4.9 A. The operating temperature range is 16°C to

32°C and the temperature gradient is 8.3°C/h maximum. The operating relative humidity range is 20% to 80% non-condensing. There are four removable disk cartridges (IBM 2316-type cartridge) in the system.

2.7/ Magnetic Tape Unit

The model 6027 magnetic tape subsystem includes control for 9-track 75 ips transport which is 800 bpi operation. The transport features uniform-tension vacuum columns designed to protect tape-stored data from damage. The 6027 uses 10 1/2" reels with 2400' of 1/2" tape. At 800 bpi, the 6027 9-track transport can store over 20 million bytes. Data transfer rate is 60 000 bytes per second via direct memory access channel. Internal microprocessor-based controller buffering of up to 16 bytes provides device latency of 250 µs. The start and stop time is 5 ms and the tape rewind speed is 200 ips nominal. The operating temperature range is 15.5°C to 32.2°C and the operating relative humidity range is 20% to 80% non-condensing. The power requirements are 120 VAC, 60 Hz and 5.5 A.

2.8/ Universal Line Multiplexer (ULM) Unit

The model 4241 ULM-5 unit provides four asynchronous lines in full-duplex operation and is a 15-inch square printed circuit board that occupies a single slot in the NOVA 4/X chassis. The ULM converts serial communications line data to parallel character transfer across the I/O bus under program control. It provides full-character buffering on all lines for transmitting or receiving data, and full modem control including auto answer for each line interface. All line interfaces are under independent program control. Each of the ULM's four asynchronous line interfaces can be programmed for parity type, code level, number of stop bits and line speed. When enabled, character parity is calculated on transmission and detected on reception. Each asynchronous interface can operate at selectable speeds up to 9600 bps. The line interface is EIA RS232C. The modem control covers Bell 103, 113, 202, 121 or equivalent.

The modem control signals are carrier detect, data set ready, ring indicator, request to send, data terminal ready, clear to send. The analog test loopback feature lets users test internal data paths, including line drivers and receivers, under program control. Individual receivers on the ULM can detect parity errors, overrun conditions and framing errors (missing stop bits). The ULM diagnostic mode facilitates separation of any hardware or software problems in the system from external data line conditions.

2.9/ Line Printer

The model 4034G 300 LPM line printer includes 4014 I/O interface and 4193 line printer controller. The 4034G has a 64-character ASCII set and operates at 300 lines per minute. It has 136 print positions per line and prints 10 characters per inch. A 136-character line buffer receives and stores the data to be printed. Each line is printed in two impressions, one for even-numbered character columns, one for odd-numbered character columns. The characters are etched on the surface of a continuously rotating metal drum. Printing occurs when a print hammer assembly strikes the drum through paper and inked ribbon. The hammer assembly contains 68 hammers, and moves laterally to print the odd and even character columns. The hammer has a life of over 500 million operations. The printer uses standard 11" fanfold, edge-punched, continuous form paper. An original and up to five copies can be produced.

2.10/ Computer-to-Computer Data Link Unit

The NOVA 4/X to HP 21MX data link unit is supplied by the data communication system supplier (ISI/3M). It interconnects the two CPUs in a master-slave relationship (the NOVA 4/X is master, the HP 21MX is slave). The NOVA 4/X data link interface is a Data General general-purpose interface board with the 16-bit input and 16-bit output data register option, and data channel (DMA) connection option. The HP 21MX data link interface utilizes the HP DMA facility and the program interrupt facility to transfer data. The two interfaces are connected by a duplex channel cable no more than 20 feet long.

2.11/ HP 21MX Communication Computer

The Broadband Data Communication System Processor (BDCSP) is a Hewlett-Packard (HP) 21MX mini-computer. The central processor has four general purpose registers, two of which may be used as index registers. It has a 16K-word semiconductor memory, expandable to 64K words. The memory cycle time is 650 ns. The initial binary loader (IBL) is ROM resident and callable by a push-button switch on the operator panel. The central processor has up to two hours of memory sustaining power with an optional power fail recovery system. It has a Dual-Channel Port Controller with bidirection input/output transfer, which provides direct memory access, program assignable to any I/O channel. There are nine I/O channels in the mainframe with a multi-level vectored priority interrupt facility. A time base generator is available for real-time data communication system control purposes. The HP 21MX contains interfaces for computer-computer channel, teletype, paper tape reader, head-end modem, and flexible disk drive. Appendix 6 shows the HP 21MX I/O slot assignment.

2.12/ Flexible Disk Subsystem

The model 12732A flexible disk subsystem consists of an HP 9885M flexible disk drive, and an HP 12735A computer interface. The subsystem is designed for use with the HP 21MX computer. The purpose of this device is to load the QEW data communication system program or communication network diagnostic program at very high speed from the flexible disk. The flexible disk drive is a random-access, mass-storage device with a capacity of up to 514 300 bytes on one removeable diskette. The flexible disk drive is self-contained and incorporates a self-test feature. The disk drive has its own internal power supply.

2.13/ Decitek Paper Tape Reader

The purpose of this device is to load a system program at high speed when processor power is off for more than two hours. The paper tape reader speed is 300 cps (characters per second).

2.14/ ASR-33 TTY

This device monitors communication system hardware status and allows stand-alone mode changeable message sign control. The printer speed is 10 characters per second. It also has a paper tape punch and reader facility. The paper tape reader speed is 10 cps. It can also serve as a backup unit for the high-speed tape reader.

2.15/ Head-end Master Data Modem

The head-end master data modem is an ISI 310 modem which handles all RF transmitting and receiving, logic functions, and serial/parallel conversions required at the head-end of a cable network. It is connected to the communication processor HP 21MX through an interrupt-driven 16-bit duplex interface. The ISI 310 head-end modem performs logic functions which include appending data received on the upstream channel with the proper modem address and interrupting the processor to which it is connected. It has an RF transmit and receive card, an RF-to-digital conversion card, and a control logic card. Only one head-end master data modem is required to control the coaxial cable network. An additional unit is available as a spare. The 310 head-end is configured to run on a sub-split two-way broadband coaxial cable system with transmitting channel centre frequency at 28.8 MHz and receiving channel centre frequency at 238.5 MHz. It is designed to handle the transmission delays caused by a long coaxial cable. With 48 000 bits per second data rate, the maximum allowable coaxial cable length from the head-end to the field station is approximately 32 km. It has the following throughput characteristics:

- 48 000 bits per second data rate
- 13 bits per word in transmitting channel
- 3692 words (time-slots) per second (48 000/13)
- 148 devices for 1/25 second polling time per device address (3692/25)
- 144 usable device addresses, since the last four addresses must be used for head-end reset.

2.16/ Two-Way Data Channels in a Coaxial Cable Network

The two-way upstream and downstream data channels to and from the traffic control centre are provided by a sub-split two-way broadband coaxial cable network. The upstream channel bandwidth is within the 50 to 250 MHz range, and the downstream channel bandwidth is within the 5 to 30 MHz range. The current downstream data channel carrier frequency is centred at 28.8 MHz. The upstream data channel carrier frequency is centred at 238.5 MHz. After 1980 system expansion, the current coaxial cable network consists of two main trunk lines. The east trunk line extends from trailer control centre (located at the Highway 10 interchange) to the Cawthra Road interchange; the west trunk line extends from the control centre to the Ford Drive interchange. Appendix 7 shows the QEW broadband coaxial cable network layout. Appendix 8 shows the new trailer traffic control centre and OPP station radio room coaxial cable layout. Appendix 9 shows the coaxial cable tap station carrier level. Appendix 10 shows the system input and output levels at the broadband amplifiers. Appendix 11 shows the connection between the data modem and the tap station.

2.17/ Field Data Modem Unit

The system contains 1-address and 4-address modems. The 4-address modems contain the following cards:

- RF (radio frequency modulator and demodulator with transmitting frequency of 238.5 MHz and receiving frequency of 28.8 MHz)
- serial
- control
- timer
- 32-bit input

The 1-address parallel I/O modems contain the following cards:

- RF
- serial
- control
- timer (in 1980 system expansion model only)
- 32-bit input (in 1980 system expansion model only)

- 8-bit input (in the original model only)

The sign control modem, a 1-address modem with RS232C I/O contains:

- RF
- serial
- control
- timer
- BRC (baud rate converter)

The RF, serial, and control cards combine to communicate with the head-end on coaxial cable and handle parallel 8-bit I/O. The 32-bit input cards buffer up to 32 bits of input connected to a modem. Appendix 12 shows the assignment of modem addresses to traffic devices. Modems numbered 1 to 11 are in the original system and modems numbered 12 to 25 are in the expansion system.

On the modems in the original system, output to the parallel I/O devices goes to the internal latch, using control code 3. (A jumper on the control card determines whether the internal latch is loaded by control code 3 or 6.) When a 3 s timeout occurs, the low-order bit (bit 0) of each output byte is changed from a 1 to a 0. The 3 s timeout is reset each time a control code 3 is received by the field modem.

On the modems in the system expansion, output to the parallel I/O devices goes to the timer card using control code 3, and the internal latch is jumpered to control code 6. The timer card asserts a specified output signal from the modem if a 3 s timeout occurs. In fact, the timeout sets the entire output byte to 0.

On the modems with RS232C I/O, the timeout turns off the carrier detect signal (pin eight of the 25-pin RS232C connector). The external devices (i.e., ramp controllers or sign controllers) use these timeout signals to take local control action.

On the changeable message sign control modem, a BRC card has a 256-byte output buffer for storing data sent from the head-end at a higher baud rate. The data are retransmitted to a sign controller at a lower baud rate according to RS232C specifications. Baud rate (switch-selectable on the BRC cards) is set to 300 for the changeable message sign controller. Data are sent from the head-end to the BRC cards using control code 0.

2.18/ Field Data Modem Input/Output Interface

Input to Modems

Each new 840 modem has a 32-bit TTL input card, which handles up to 32 parallel input bits from devices with open collector outputs. Input levels are as follows:

Logic Level	Input Signal
0	Open circuit, which input card pulls up to +5 V
1	Ground, for which external device must sink approximately 20 mA

These modems are configured for internal strobing, so that they read the data on the input lines every time a head-end reset occurs (approximately 25 times per second).

Output from Modems

Each new 840 modem has a new timer card, which buffers output data from the computer, provides eight parallel output bits to a ramp controller, and notifies the controller if communication with the head-end is broken. Each timer card has a 3 s timer which is reset every time the Traffic Control Computer sends data to the modem. If the modem receives no data from the computer for 3 s the timer card sets all eight output bits to 0.

The ramp controller then enters local control. Each timer card provides open collector TTL outputs. Output levels are as follows:

Logic Level	Output Signal
0	Open circuit, which ramp controller pulls up to +12 V
1	Ground, capable of sinking approximately 40 mA from ramp controller

For system testing, the timer cards may be used to generate input to the modem via wrap-around connections. Each timer card has a DIP switch which selects the address modulus 4 of the output byte from the modem. For instance, if address 17 octal had a 1-address modem, then setting the timer cards switch for address 3 would cause the proper output byte to be sent out.

2.19/ TDM Coaxial Cable Data Communication Scheme

Downstream data are sent from the head-end along the coaxial cable to the field data modem; upstream data are sent from each remote data modem back along the coaxial cable to the head-end.

Downstream data communication is accomplished on a single time-shared channel with a modem addressing scheme. To send data to a traffic device connected to a particular modem address, the head-end first selects the unique address in the data modem, sends the data and then deselects the modem address. Each downstream data word consists of 1 start bit, 3 bits of control code followed by 8 bits of data and 1 stop bit. The three control bits generate eight combination control words.

Upstream data communication is accomplished by a Time Division Multiplexing (TDM) System. The same modem addresses used in the downstream data channel are used to define a sequence of time slots in the single upstream data channel. Therefore, the modem addresses "N" will have the opportunity to send upstream data during the Nth time slot. Although the time slot addresses are fixed in the hardware, the head-end modem uses control codes to ensure that the phase counters (which control the upstream data channel time slots in all the modems) are synchronous with one another by issuing a "Run Phase Counters from Zero", every 148 downstream data words.

Besides the normal data communication mode of operation, the data modems may be set into an enquiry state. In this state the upstream channel data are inhibited and all field data modems send their device address in their respective time slot. This is a positive indicator to the head-end that the greater part of the modem circuitry is operating correctly.

2.20/ Coaxial Cable Data Communication Range

In the 1980 system expansion, the coaxial cable has been extended to longer than 12.8 km (8 miles) which is beyond the existing head-end modem capability for controlling the remote modems. As a result, the head-end modem was modified by ISI/3M to control longer coaxial cable. Maximum controllable cable lengths before and after the modification are shown in Table 1.

Appendix 13 describes the details of the cable delay modification which allows the head-end to control the coaxial cable up to 128 km in length when the system is operating at a 12 000 bits per second data rate.

2.21/ Loop Detector Unit and Interface

The original system loop detector unit is the Traffic Data Systems Inc. Loop Detector series LD328 which is designed to operate with a wide range of loop configurations. After initial manual tuning, tracking of environmental changes is automatic. The power supply is an integral part of the detector unit, with all controls mounted on the front panel . Two sensitivity levels, three presence modes, and four operating frequencies enable the detector unit to accommodate the usual configurations of loops and lead-ins.

The loop detector unit provides reliable detection by phase comparison means with an accuracy of better than 99% of all vehicles passing over the loop at speeds of 1 to 80 mph. The operation of the detector unit is not affected by changes in the inductance of the loop caused by environmental changes. The output of the (LD328 loop) detector unit is a fail-safe relay with isolated contacts or a solid state NPN open collector output. A matching circuitry interface box is supplied by ISI for each data modem to connect loop detector unit output to the data modem.

There are 77 loop detectors installed for the original QEW FSCS demonstration project. Table 2 shows the mainline speed sampling loop detector spacing. All the mainline loops have a size of approximately 6' x 6'.

In the 1980 system expansion, the number of mainline detector stations was increased to 22 and the total number of loop detectors was increased to 180. Proceeding west from the O.P.P. trailer in Port Credit, the detectors are numbered 1 through 148, and proceeding east, 501 through 532. There are 67 x 2 = 134 mainline double-loop detectors, and 46 single-loop detectors, listed in Appendices 12 and 23.

2.22/ Ramp Controller Unit and Interface

After 1980 system expansion, there are two types of ramp metering controller, the TDS CR710, and the Type 170, as listed in Appendix 21.

CR710 Ramp Controller

The TDS CR710 ramp controller used in the original QEW system is designed for metering traffic onto freeways from conventional access ramps. They are installed at the Highway 10 N/B, Highway 10 S/B, Mississauga N/B, Mississauga S/B, and Southdown Road entrance ramps.

The controller sequences through green, yellow, and red signal intervals, allowing motorists to enter the traffic flow at a selected rate. Demand and passage loops enable the controller to operate in either loop-actuated or pretimed modes, allowing vehicles on the ramp to enter on a demand basis or at a pretimed rate.

Traffic flow rate can be chosen by three different modes:

1/ Time-of-day clock choosing one of six preloaded cycle lengths. This mode can also be activated by a relay controlled hardware switch located in the control centre.

2/ Mainstream occupancy actuated, in which the CR710 chooses one of six preloaded cycle lengths based on mainstream occupancy.

3/ Remote computer mode, in which the CR710 operates as a slave controller executing the computer commands. The computer commands override the mode 1 or mode 2 operation. To relieve the potential entrance ramp traffic congestion, a ramp queue override feature was implemented under local control operation modes (i.e., modes 1 and 2).

Appendix 14 describes the CR710 ramp queue override function. Reference 1 describes the details of the CR710 ramp controller operation principle.

The data modems provide 8-bit parallel input and output interface with the CR710 ramp controller. It has the interface assignments shown in Table 3.

Appendix 15 provides a detailed description of interface functional assignment.

Each data modem logic level output is an uncommitted NPN transistor collector which when turned on sinks 2 mA at less than 1 V and which when turned off leaks less than 10 µA at 25 V. Each data modem logic level input is turned ON when the input voltage is less than 2 V; is turned OFF when the input current is less than 100 µA; does not place more than 20 V or any negative voltage on the inputs; and does not deliver more than 10 mA to a short circuit to d.c. common.

Type 170 Ramp Controller

The Type 170 ramp controllers were used in the 1980 system expansion. Type 170 is the standard MTC traffic signal controller. Reference 2 describes the Type 170 hardware function and specification. The Type 170 ramp controller software is based on Caltrans District 11 ramp metering software version 6.75 with modifications made by MTC on the communication interface and the ramp queue override function.

The software allows the 170 controller to control two ramps at the same time. Thus, there is only one 170 controller at each new interchange (i.e., Cawthra Road, Winston Churchill, and Ford Drive). The remote ramp control command bit will be transmitted from the traffic control computer to the 170 controller through input port 5. The 170 controller will return the ramp control command status to the traffic control computer with a similar command bit pattern arrangement through output port 3. Since one 170 controller will control two ramps, the traffic control computer will normally alternate between ramp 1 and ramp 2 remote control command. Table 4 shows the 170 remote ramp control command definition.

The ramp queue override is similar to that implemented by the central traffic control computer.

2.23/ Changeable Message Sign Controller Unit and Interface

Each changeable message sign (CMS) used in the QEW FSCS is a very low power consumption, high visibility, high reliability, rotation coloured magnetic disc type display. Each CMS station consists of a sign display, and a sign controller with an RS232C interface which is connected to a sign data modem. The sign display consists of two lines, each 22 characters (modules) long. Each module consists of 5 x 7 rotating disc display elements. The typical viewing distance is 180 m (600 feet) at a degree from normal viewing angle. This provides approximately 7 s of viewing time, ample for motorists travelling at 100 km/h. Appendix 16 shows the sample sign display and format. The sign controller's serial communication input and output interface operates at a data rate of 300 baud. It accepts serial 10-bit ASCII character data which consists of 1 start bit, 8 data bits with even parity check bit, and 1 stop bit. Appendix 17 shows the sign display character symbol and its corresponding ASCII code. The CMS controller recognizes a fixed format message which consists of an address portion and a data portion from the traffic control computer. Appendix 18 shows the CMS controller input message format. In addition, the CMS controller has the capability to display the lines of a message in any order and to echo back each received character for verification purposes. In the event of power failure, an automatic blankout feature provides protection against the display of incorrect messages. The blankout feature will also be activated when the CMS controller receives a blankout control character.

When the CMS controller exercises the blankout feature, a "Break" signal will be presented on the echo signal line from the CMS controller to the CMS data modem. Appendix 19 shows the interface connector pin assignments between the CMS controller and the CMS data modem.

3/ SOFTWARE DESCRIPTION

The QEW FSCS real-time software runs under the Mapped Real-Time Disk Operating System (MRDOS) on the NOVA 4/X mini-computer. This traffic control computer is the master decision-maker in the overall system. Through a front-end processor, it communicates with the field traffic devices to perform traffic surveillance and control.

3.1/ Overview

The overall system organization is a three-level hierarchical structure. The first level consists of the ramp controllers, loop detectors, and sign controllers which are installed in the field. The second level consists of the front-end communication processor and data modems which are linked to the ramp controllers, loop detectors, and sign controllers through the coaxial cable network. The communication processor samples (in real-time) the vehicle detector signals, and commands the ramp and sign controllers according to the messages transmitted from the traffic control computer. The third level consists of the traffic control computer which is connected to the communication processor through a duplex data channel interface. The traffic control computer, which performs the co-ordinated ramp control logic, incident detection logic, and CMS control logic is the master decision-maker in the whole QEW FSCS system.

Dynamic freeway traffic information is collected by the loop detectors and transmitted to the front-end communication processor through a dedicated high-speed (48 000 bits per second) time-division multiplexing data communication system. The communication processor manipulates the freeway traffic data and presents the data, in terms of vehicle signal elapsed time and volume, to the traffic control computer once per second. The traffic control computer then assesses the system-wide information about traffic conditions and responds to meet the changing traffic behaviour by sending ramp controller signal cycle length commands and CMS messages to the communication processor. The communication processor then transmits the signal cycle length commands and the CMS messages to the corresponding ramp and sign controllers. The ramp controller also has the capability to operate independently in a time-of-day clock mode or mainline occupancy actuated mode. The communication processor has the stand-alone CMS control capability. Thus, any failure in the central traffic control computer system will not completely stop system operation. The various real-time FSCS software programs are shown in a simplified functional block diagram in Appendix 20. The programs are written in real-time FORTRAN IV and assembler languages and are under control of a master task-scheduling program.

3.3/ FSCS Real-Time Task Analysis

In general, the real-time FSCS software has to perform the following basic tasks:

1/ Sampling and processing of traffic detector data pulses
2/ Smoothing and accumulation of the traffic detector data
3/ Freeway incident detection
4/ Ramp metering signal control and monitoring
5/ Changeable message sign control and monitoring
6/ Field hardware status monitoring
7/ System operator command interpreting
8/ Traffic system status displaying
9/ Data communication

The traffic detector data processing and hardware status monitoring tasks require the input of digital signal values and the updating of these values at fixed, precise intervals in order to provide the data for other traffic control and analysis task programs. These intervals range from fractions of a second to minutes and hours. Although this periodic interval length is large compared to the response time (in microseconds) of a digital computer, the number of variables (hundred-to-thousands) involved is large enough so that these task programs must be very efficient in order to avoid using an excessive fraction of computer capability and to ensure that the data is updated precisely at the correct time.

Similar requirements are also present in the freeway incident detection, the ramp metering signal control, and the changeable message sign control tasks which use traffic process data and a number of filtering and control algorithms in order to calculate the appropriate output to be transmitted to the ramp and sign controllers. These control algorithms and their associated outputs must be recalculated and updated periodically at approximately the same rate as the traffic detector data acquisition tasks and with the same precision.

Operation of the system operator command interpreting task and the traffic system status displaying task may be periodic (as in the display of traffic data gathered by the traffic data acquisition task) but it is also often required to provide fast response to random demand (e.g., when the system operator is attempting to communicate with the traffic control programs in order to change their operation or parameters). In short, the real-time FSCS software is concerned with a large number of surveillance and control tasks, each of which is repeated rather often with strict real-time response constraints.

In the QEW FSCS, Task 1 is carried out by the HP 21MX communication computer at 1/25 second intervals. Task 5 can also be carried out by the communication processor when operating in the stand-alone mode. Tasks 2 to 8 are carried out by the traffic control computer. Task 9 requires the co-operation of the communication computer and the traffic control computer.

3.3/ Mapped Real-Time Disk Operating System

The operating system used for the QEW FSCS software is the Mapped Real-Time Disk Operating System (MRDOS) which operates on the NOVA 4/X traffic control computer. The MRDOS is a vendor-supplied software package which supplies the real-time multi-task programming environment for the FSCS application software. When initiated by real-time FSCS software, the MRDOS operating system provides real-time task scheduling, memory management and protection, program overlay, input-output management, data file management, foreground and background programming and other functions required for real-time multi-task operation.

Since the MRDOS is oriented towards the computer hardware, it has to be configured and generated according to the QEW FSCS software requirement. This procedure is called system generation and is well documented by the vendor. The other software support packages which operate under MRDOS are the FORTRAN IV compiler (FORT), macro-assembler (MAC), editor

(NSPEED), command language interpreter (CLI), relocatable loader (RLDR), FORTRAN IV run-time library, etc.

3.4/ FSCS Real-Time Application Software

The application software is task-oriented, modular in structure, and designed mainly in real-time FORTRAN high-level language for its flexibility, and runs under the MRDOS operating system. There are 70 programs in the QEW FSCS real-time application software system. These 70 programs are organized into five real-time tasks and require three overlay nodes in the logical memory address space. (Besides the 70 program files, the FSCS real-time software system also contains seven-colour graphic display support data files, two CMS files, and four ramp-metering support files. When in operation, the FSCS real-time software system outputs eight traffic and system data files for subsequent off-line analysis). The FSCS real-time software system's memory-resident programs occupy approximately 44K bytes of memory and its disk-resident programs occupy approximately 74K bytes. To run the QEW FSCS real-time software system requires 64K bytes of user logical memory address space, of which 44K bytes are for main memory-resident programs and 20K bytes are for run-time data buffers. In addition, approximately another 64K bytes of logical memory address space are required to house the MRDOS software package. Appendix 36 includes the real-time FSCS application program overlay structure and program size.

The five real-time task organization was developed to satisfy both the periodic nature of the surveillance and control functions and the external asynchronous random demand input. These five real-time tasks are as follows:

- QEW -- System real-time task scheduling and operator command interpreter program
- COMCOM -- One-second communication and data processing program
- TRANSF -- Thirty-second data acquisition and control program
- GMAP -- One-minute colour graphic display program
- CORCAS -- One-minute dummy program reserved for future corridor control and surveillance.

Appendix 22 shows the real-time multi-task scheduling sequence.

3.5/ System Task Scheduling Program

The QEW FSCS real-time software system is activated by the system task scheduling program "QEW", which performs the following tasks:

1/ It opens overlay file "QEW.OL".

2/ It calls overlay subroutine "INITIALIZE", to:
   a) initiate tasks "COMCOM", "TRANSF", "CORCAS", and "GMAP", in descending order of priority;
   b) define the HP 21MX front-end communications processor to MRDOS;
   c) open an output channel to the Tektronix 4027 colour graphics terminal;
   d) create or restore the eight F.S.C.S. data files.

3/ It calls overlay subroutine "HEADING", to:
   a) query the operator for the initial environmental conditions;
   b) check the real-time clock so as to start executing the program on a multiple of 5 minutes;
   c) display the system identification and start-up message on the console;
   d) define a user clock, supplying an interrupt every second, to MRDOS;
   e) save the initial date, time, and conditions in file "WEATHER".

4/ It calls subroutine "TOPCOM" to process the operator commands. It remains in this routine until the operator issues the "F" command in the "JCW" group. At that time, the main program "QEW" resumes.

5/ It closes overlay file "QEW.OL", stops, and returns control to MRDOS.

3.6/ Communication Program

This task program "COMCOM" polls the front-end communication processor at one-second intervals for the most recent (real-time) traffic and field hardware status data and transmits the appropriate ramp metering and sign control commands to the communication processor through the duplex DMA data channel. Data communication is accomplished through the execution of different protocols that are designed to accommodate different data transmission needs. The communication processor acts as a messenger, relaying the data between the traffic control computer and the field hardware devices.

Once activated by the "INITIALIZE" routine, the "COMCOM" task program suspends itself by calling the system task synchronization routine "REC". From then on, this task program becomes active only when "CLOCK" routine calls the corresponding system task synchronization routine "XMT". Specifically, the "COMCOM" program performs the following tasks:

1/ It suspends itself until interrupted every second by assembly-language routine "CLOCK".

2/ When activated, it executes protocol 1 to read the 545-word traffic data buffer "DETECT" from the communication processor. Appendix 23 shows the "DETECT" buffer format.

3/ It calls subroutine "DATAIN" to process one-second volume, occupancy and speed data. Every 30 seconds, "DATAIN" activates task "TRANSF"; every 60 seconds, it activates task "CORCAS".

4/ It calls subroutine "MODM1" to accumulate modem response error counts and to disable or enable detectors based on data modem status.

5/ It calls subroutine "RAMCON" to prepare ramp metering control command buffer "COMDOP" and to check transmission errors. Appendix 24 shows the "COMDOP" ramp control command buffer format.

6/ It executes protocol 2 to transmit ramp metering control commands to the communication processor.

7/ Every 10 min, it executes protocol 3 to receive modem echo counts.

8/ When requested by the operator through flag word "P4FLG", it executes protocols 4 and 5 to transmit and receive CMS messages.

9/ It goes back to step 1.

3.7/ Traffic Surveillance and Control Program

This task program accumulates and computes the real-time traffic data and saves the data files on disk. It also activates the incident detection program, ramp control program, and hardware monitoring program. The traffic data base created and managed by this program contains both lane and station values of volume, occupancy, speed, and long vehicle count, each updated at 30-s, 1-min, and 5-min intervals. The entire traffic data base is disk-resident and is divided into three groups as follows:

- Group 1 -- 30-s volume, occupancy, speed, long vehicle counts by lane
- Group 2 -- 30-s volume, occupancy, speed, by station
  -- 1-min volume, occupancy by station updated every 30 s
- Group 3 -- 5-min volume, occupancy, speed, long vehicle count by lane

The programs required to create and utilize the preceding traffic data base are described as follows.

(1) TRANSF Program

This is the main 30-s traffic surveillance and control task program. It performs the following tasks by overlaying various subroutines from overlay file "QEW.OL".

(1.1) It suspends itself until activated every 30 s by subroutine "DATAIN".

(1.2) It obtains the current time and date from the real-time clock and calendar.

(1.3) It calls overlay subroutine "UPD30S" to process 30-s time slice traffic data.

(1.4) One minute after the system has started, it calls overlay subroutine "INCDET" to execute mainline station incident detection.

(1.5) It calls overlay subroutine "PERCHK" every 30 s to perform station incident detection 1-min persistance check algorithm.

(1.6) It then calls overlay subroutine "DATSTR" every 30 s to extract 30-s time slice mainline lane data for freeway lane incident detection algorithm.

(1.7) It calls overlay subroutine "CLDU" every 30 s, to execute first-layer committee machine algorithm for freeway lane incident detection.

(1.8) It calls overlay subroutine "VTLU" every 30 s to execute second-layer and third-layer committee machine algorithm for freeway lane incident detection.

(1.9) It then calls overlay subroutine "RCTIME" every 30 s to perform coordinated traffic responsive freeway ramp metering control.

(1.10) It calls overlay subroutine "QUOCC" every 30 s to perform balanced ramp queue override control.

(1.11) It calls overlay subroutine "ALM30S" every 30 s to check field hardware device status, i.e., double loop detectors, ramp metering contollers, ramp metering signal lights, and changeable message sign controllers.

(1.12) It calls overlay subroutine "ALM5M" every 5 min to check loop detector failure on 5-min time slice and 15-min time slice basis.

(1.13) It calls overlay subroutine "AMODM" every 10 min to check data modem hardware and to output date and time message on the operator console.

(1.14) It calls overlay subroutines "DIS1" and "DYS1" every 30 s to merge 30-s time slice data into 1-min time slice data for colour graphic display file "QEWDYN".

(1.15) It calls overlay subroutine "DIS2" every minute to update 1-min time slice ramp control and mainline station data on colour graphic display file "QEWDYN".

(1.16) It activates colour graphic map program "GMAP" every minute.

(1.17) It sends the beep sound every 30 s to the operator console when there is a hardware device alarm signal.

(1.18) It then goes back to step 1.1.

3.7.1/ Traffic Data Acquisititon Function

The traffic data acquisition function is accomplished jointly by a one-second program "DATAIN", and the 30-second programs "UPD30S", "DIS1", "DYS1", and "DIS2"

(1) DATAIN Program

This program is called by one-second task program "COMCOM", after obtaining detector data buffer from the HP 21MX communication computer. Along with the SLCHEK, DLCHEK, and NXFER subroutines, the program performs the following tasks:

(1.1) It checks detector data in the "DETECT" buffer for logical consistency:

- $0 < \text{volume} < \text{MAXVEH}$ (=4)
- Accumulated occupancy/volume > IMIN (=3)
- Accumulated double elapsed time/volume > IMIN (=3)

(1.2) It rejects out-of-range data and accumulates valid data every second.

(1.3) It processes speed sampling loop detector data, taking lane change into account.

(1.4) It stores ramp metering signal lights status for each metered on-ramp.

(1.5) At the end of every 30 s, it calls NXFER routine to transfer accumulated data to 30-s working buffers VSPEED, DATA30, and LIGHTS and reinitializes the one-second buffers.

(1.6) It then activates task "TRANSF" every 30 seconds, and task "CORCAS" every 60 seconds.

(2) UPD30S Program

Basically this routine consolidates three-lane data into a station data. If data are not available in one lane, then station data are computed using the data from the other two lanes. The program performs the following tasks:

(2.1) It checks the validity of 30-s traffic data and sets the data to -1 if faulty. For single-loop detectors, only volume and occupancy are checked. For double-loop detectors, speed and vehicle-type data are OK only if both upstream and downstream detectors are OK.

(2.2) It consolidates lane data into 30-s and 1-min station data. Station volume and occupancy counts are in terms of three-lane equivalent counts. Station data are set to -1 if all lane data found faulty.

(2.3) It computes section travel time as the ratio of section distance to the average speed of the upstream and the downstream stations.

(2.4) It writes the 30-s data to the disk file "DATA30" every 30 s.

(2.5) It accumulates 5-min data and writes to the disk file "DATA5M" every 30 s.

(3) "DIS1" Program

This program updates part of the colour graphic display file "QEWDYN" every 30 s. It performs the following tasks:

(3.1) It opens "QEWDYN" file and initializes local buffer QEWDYN.

(3.2) It defines number of queue detectors and exit detectors for each ramp in the array IDNO(10) and stores date and time information in the QEWDYN buffer. The most significant digit of each element of the array IDNO(10) contains the number of queue detectors for that ramp, and the least significant digit contains the number of exit detectors.

(3.3) It increments a 30-s counter to determine if it is the end of the minute. If not, it processes the current 30-s single loop detector data and mainline data in the upper part buffer of "QEWDYN" and store them in disk file "QEWDYN".

(3.4) It closes disk file "QEWDYN".

(4) DYS1 Program

At the end of the minute, this program performs the following tasks:

(4.1) It reads the preceding 30-s data from the disk file "QEWDYN" and integrates with the present 30-s data into 1-min data. The 1-min data includes 1-min ramp detector volume, occupancy, 1-min mainline lane volume, occupancy, and speed data.

(4.2) It writes the 1-min data to the disk file "QEWDYN".

(5) DIS2 Program

At the end of the minute, this program performs the following tasks:

(5.1) It reads ramp controller cycle length from "CYCLES".

(5.2) It updates mainline control mode, cycle length, ramp waiting time and smoothed queue detector occupancy in the buffer "QEWDYN".

(5.3) It updates station capacity, speed, volume, and occupancy (1-min data) and incident status.

(5.4) It writes to the disk file "QEWDYN" and records file number to disk file "DMPREC".

3.7.2/ Station Incident Detection Function

This program is called every 30 s to detect freeway station incidents. It consists of two routines, INCDET and PERCHK, and performs the following tasks:

(1) It computes four incident test values which are rounded off in percentage assuming 25 samples per second. The four test values are as follows:

- $OCC_{i,t}$ = occupancy at detector station i at time t
- $(OCC_{i,t} - OCC_{i+1,t})$ the occupancy difference at time, t, between the station, i, being tested and its downstream station, i+1.
- $(OCC_{i,t} - OCC_{i+1,t}) / OCC_{i,t}$ = the relative percentage occupancy difference between the station, i, and its downstream station, i+1, at time, t.
- $(AVGOCC - OCC_{i+1,t}) / AVGOCC$ = the relative percentage occupancy difference between time, t, and the average 30-s occupancy AVGOCC, at the downstream station, i+1.

  Where $AVGOCC = (OCC_{i+1,t-30} + OCC_{i+1,t}) / 2$.

(2) It checks incident occurrence at the station, i, only if station i is cleared for any incident at time, t. An incident is detected, if all the four test values exceed the four threshold values at the station, i.

(3) It checks for the incident clearance at the station, i, only if there is a true incident at station, i, at time, t. An incident is cleared, if any one of the following conditions is satisfied:

$(OCC_{i,t} - OCC_{i+1,t}) / OCC_{i,t}$ less than threshold value, and $OCC_{i,t}$

less than $OCC_{i,Ti}$ and $OCC_{i+1,t}$ larger than $OCC_{i+1,Ti}$ (where T_i indicates the time preceding the occurrence of incident).

(4) It performs 1-min incident persistency check for the incident detected. The incident detected is regarded as "true" if it lasts at least 1 min.

(5) The incident data are written to disk file "INCLOG" for any true incident when it occurs as well as when it is cleared. The maximum mainline queue length is also computed and stored.

3.7.3/ Lane Incident Detection Function

This program is called every 30 s to detect freeway lane incident after station incident has been identified. The logic is based on Reference 3. It consists of three routines, DATSTR, CLDU, VTLU and performs the following tasks:

DATSTR

- It determines if a true incident has occurred in any station, i.
- It then obtains preceding 1-min logical records from disk file "DATA30" which stores 30-s time slice data.
- It retrieves lane occupancy, lane volume and lane speed data and stores in the buffer "DATAX".
- It obtains average station occupancy, station volume and station speed and stores in "DATAX".
- It writes "DATAX" buffer to disk as logical record in "DATAX" file.

CLDU

This routine implements a committee logic decision unit process. The routine selects lanes based on decision parameters occupancy, volume and speed which are selected from three 30-s time slice data.

(1) It checks through stations 1 to 21 for new station incident indication and skips station 3 which is located on Highway 403.

(2) If a station incident is found at station, i, it reads DATAX file for the station i and i+1 data and lane data.

(3) It then implements the committee logic decision unit based on the occupancy parameter according to the following process:

(3.1) It selects the lane, n, with the minimum lane occupancy at the downstream station, i+1, at time slice T.

(3.2) It computes:

$$O_n\ (T) = (AVGOCC_{T,i+1} - MINOCC_{T,i+1}) \ /\ AVGOCC_{T,i+1}$$

where: $MINOCC_{T,i+1}$ = minimum lane occupancy at lane, n, of downstream station, i+1, at time T.

$AVGOCC_{T,i+1}$ = average downstream station occupancy at time, T.

(3.3) If $O_n(T)$ is larger than the threshold value, the incident is detected at lane, n.

(3.4) If $O_n(T)$ is less than the threshold value, then the lane at the station i with the maximum lane occupancy is selected as the incident lane.

(3.5) It stores the incident lane information in the file "RESDEV".

(3.6) It repeats the steps (3.1) to (3.5) for time slices T-30, and T-60.

(4) It implements the committee logic decision unit based on the volume parameter according to the following process.

(4.1) It selects the lane, n, with the minimum lane volume at the downstream station, i+1, at time slice, T.

(4.2) It computes:

$$V_n(T) = (AVGVOL_{T,i+1} - MINVOL_{T,i+1}) / AVGVOL_{T,i+1}$$

where: $MINVOL_{T,i+1}$ = minimum lane volume at lane, n, of downstream station, i+1 at time T.

$AVGVOL_{T,i+1}$ = average downstream station volume at time, T.

(4.3) If $V_n(T)$ larger than the threshold value, then the incident is detected at lane n.

(4.4) If $V_n(T)$ less than the threshold value, then the lane at the station i with the minimum lane volume is selected as the incident lane.

(4.5) It stores the incident lane information in the file "RESDEV".

(4.6) It repeats steps (4.1) to (4.5) for time slices T-30 and T-60.

(5) It implements the committee logic decision unit based on the speed parameter according to the following process:

(5.1) It selects the lane, n, with the minimum lane speed at the station, i, at time slice T.

(5.2) It computes

$$\int_n(T) = (AVGSPD_{T,i} - MINSPD_{T,i}) / AVGSPD_{T,i}$$

where

$MINSPD_{T,i}$ = minimum lane speed at lane, n, of the station, i, at time T.

$AVGSPED_{T,i}$ = average station speed, at time T

(5.3) IF $\int_n(T)$ larger than the threshold value, then the incident is detected at lane, n.

(5.4) If $\int_n(T)$ less than the threshold value, then the lane at the downstream station, i+1, with the maximum lane speed is selected as the incident lane.

(5.5) It stores the incident information in the file "RESDEV".

(5.6) It repeats the process for time slice T-30, and T-60.

(6) It deletes the file "DATAX".

VTLU

This routine implements a vote-taking logic unit. The routine counts the lane selection (i.e., votes) from the CLDUs and makes the decision based on the majority rule.

(1) It checks through stations 1 to 21 for a new incident detected and skips station 3.

(2) If an incident is found at station, i, it reads "RESDEV" file to obtain three incident lane selections made by each of the CLDUs.

(3) It compares lane selections made by occupancy CLDU.

(4) If any two agree, they automatically form a two-out-of-three majority. The outcome (i.e., decision) is set to the value of the comparison pair which gives the majority ruling.

(5) If no two agree, then all are different and a three-way tie has resulted. The outcome is reset to 0, and considered a null vote which will not be counted.

(6) It repeats steps 3 to 5 with lane selection result from volume CLDU.

(7) It repeats steps 3 to 5 with lane selection result from speed CLDU.

(8) It modifies the lane vote total from occupancy CLDU, by applying occupancy weighting factor.

(9) It modifies the lane vote total from volume CLDU, by applying volume weighting factor.

(10) It modifies the lane vote total from speed CLDU by applying speed weighting factor.

(11) It then chooses the lane with the maximum number of votes as the lane of incident.

(12) It writes lanes incident data to "INCLOG" and "RESDEV" files.

3.7.4/ Ramp Control Function

The ramp control function is accomplished jointly by one-second program RAMCON, and 30-s programs RCTIME, and QUOCC. The RCTIME and QUOCC programs calculate a new metering strategy every 30 s according to existing traffic conditions. Since the calculation is made each 30 s to determine the metering strategy for the next 30 s, the feedback from the metering strategy is for all practical purposes a continuous operation. Under this system control strategy, a given entrance ramp to be metered would have upstream, local, and downstream detector stations assigned to provide upstream station volume, local station occupancy, and downstream station occupancy data. The strategy would compare each of these three parameter measurements against a table of threshold volume and occupancy values, and pre-assigned metering rates would be obtained for each of these measurements.

The smallest of the determined metering rates is then selected. In order to balance the ramp queue length and mainline traffic condition, a ramp queue override feature is implemented by the QUOCC program. When the ramp queue override feature is not activated, the entrance ramp would meter at the selected minimum metering rate over the next 30 s, at which time the parameter's measurement would again be evaluated for the following 30-s metering rate, and so on. If the ramp queue override feature is activated, the selected minimum metering rate may be replaced by a higher metering rate picked by the QUOCC program for the next 30 s. This control process will be repeated every 30 s. Appendix 25 describes the computerized ramp metering rate selection logic and Appendix 26 describes the ramp queue detection logic and ramp queue override feature.

RCTIME

This program selects the ramp metering rate (cycle length) based on the mainline traffic condition.

(1) It obtains assigned mainline detector station number for each entrance ramp from disk file "RAMTAB".

(2) It obtains threshold values of occupancy for the local and downstream station, the threshold value of volume for the upstream station, and the corresponding cycle length for each of six different metering threshold values from disk file "CYCTAB".

(3) It computes control period, and by default, automatic advancement in control period is implemented.

(4) If the control period equal to "0", then:

(4.1) It assigns permanent green to those ramps not under manual command override.

(4.2) For those ramps under manual command override, it leaves them as they are.

(4.3) It returns the program control to the TRANSF program.

(5) If the control period is equal to "1", "2", or "3", then:

(5.1) It ignores those ramps dropped offline, i.e., in non-metering condition, during control period 3, or under ramp queue override condition, or under manual command override condition.

(5.2) For each ramp to be controlled according to the mainline traffic condition, it locates the corresponding mainline detector station number and volume column number from table "RAMTAB".

(5.3) It then derives the cycle length based on the comparison between the mainline detector station occupancy, volume and the threshold values stored in table "CYCTAB". The mainline detector station data used for metering rate (or cycle length) selection will be the latest 1-min running average occupancy by station and the latest 1-min running average volume by station. These 1-min running average volume and occupancy data are updated every 30 s. The cycle lengths derived range from no metering (green) to cycle length number 1 to 5. In control period 1, once a ramp starts metering, it will be metered at least with minimum cycle length number (maximum metering rate). In control period 2, all ramps are metered at least with minimum cycle length number. Three different cycle length numbers are selected by comparing mainline downstream and local occupancy and upstream volume with their corresponding threshold values. The cycle length chosen is the largest of the three and is stored in the RAMCYC buffer.

(5.4) It then determines the ramp metering control mode and stores in the MODCYC buffer.

QUOCC

This program modifies, if necessary, the ramp metering rate (cycle length) selected by the RCTIME program based on the ramp queue length condition.

(1) It obtains ramp queue length vs ramp queue detector occupancy table and ramp controller cycle length table from disk file QUETAB and CYCLES.

(2) It smooths 30-s ramp queue detector occupancy values.

(3) It initializes ramp queue lengths and ramp waiting time to 0.

(4) It bypasses step 5 for each ramp if:
- there is no metering condition in control period 1 or 3,
- the ramp controller is in local control mode (RAMCYC=6), or
- the control period is 0.

(5) For each ramp,

- It computes ramp queue length. Mississauga S/B has ramp queue length equal to the sum of the ramp queue lengths derived from the two queue detectors; Erin Mills and Ford Drive have queue length equal to the maximum of the two queue lengths. The ramp queue length and ramp waiting time is set to -1 if queue detector fails.

- It modifies ramp metering cycle length based on ramp queue override logic. If an entrance ramp is not under manual command override or ramp queue override logic function is not disabled by operator, ramp queue override logic is "on" when the ramp queue detector occupancy value exceeds the upper bound threshold value and "off" when it falls below the lower bound threshold logic.

- It computes ramp waiting time.

RAMCON

This program is activated by task program COMCOM every second to transmit the ramp controller cycle length command to the front-end communication computer which relays the command to the field ramp controller.

(1) It looks for manual cycle length override commands entered by the operator or cycle length commands generated by RCTIME or QUOCC.

(2) It translates cycle length command into command bit pattern and stores it in command buffer COMDOP. For dual ramps which are controlled by one type 170 controller, control commands are transmitted every 2 s per ramp. For a single ramp which is controlled by one CR710 controller, commands are transmitted every second.

(3) It stores both transmitted control commands and received controller status for each ramp.

(4) It checks transmission errors for both types of controllers, CR710 and type 170. If the number of consecutive errors exceeds 30, then the status bits are saved in the CHEK1 buffer and the command bits are saved in the CHEK2 buffer.

3.7.5/ Field Hardware Monitoring Function

The field hardware monitoring function is accomplished by one-second routine MODM1, 30-s routine ALM30S, 5-min routine ALM5M, and 10-min routine AMODM.

MODM1

This routine is activated every second by the task program COMCOM.

(1) It checks and accumulates data modem response counts from buffer DETECT. If the response counts differ from the nominal count (25) by three (3) or more, error counts are accumulated in the buffer MODEM1.

(2) It disables detectors connected to the data modem which do not respond five consecutive times.

(3) It enables detectors connected to the data modem which responds five consecutive times after failing.

(4) It increments a 10-min time counter for activation of AMODM program.

(5) It transfers data modem error counts to the MODEMT buffer every 10 min.

ALM30S

This routine is activated every 30 s by the task program TRANSF to monitor mainline detector, ramp controller, signal light and CMS hardware status.

(1) It checks mainline detectors for malfunction when the detector station speed is greater than 14 m/s (approximately 50 km/h). Under this condition, a mainline detector is considered faulty if the 30-s detector occupancy value exceeds 95%.

(2) It checks the command data transmitted by the traffic control computer against the echo-back status from the ramp controller.

If the command data bit is inconsistent, the error bit is recorded in the buffer CSTAT.

(3) It checks each ramp metering signal light according to the following conditions:

(3.1) When RAMCYC(I) = 0, the corresponding entrance ramp should have the green light ON.

(3.2) All green, yellow and red lights should be ON at least once during the past 30 s for a normal metering cycle (RAMCYC(I) ≠ 0); if not, the demand detector volume must be 0. An error message is delivered to the operator only if three consecutive errors were found. The light status error is recorded in the buffer LTSTAT.

(4) It records sign malfunction information to disk file ALMREC when notified by subroutine T14D through flag ALMFLG.

(5) It records any hardware malfunction to disk file ALMREC and notifies the operator by beeping the console.

ALM5M

This program is activated every 5 min by the task program TRANSF to monitor detector hardware operation.

(1) It obtains 5-min time slice detector data from disk file DATA5M.

(2) It accumulates and checks 15-min exit ramp detector volume. If the 15-min volume is less than threshold value (EXVOL = 1), the exit detector is considered failed.

(3) It checks single loop and mainline double loop detectors according to the following conditions:

(3.1) for demand detector -- 5-min occupancy > 1%
(3.2) for exit detector -- 5-min occupancy < 95% or

15-min volume > 1

(3.3) for passage, queue, and mainline detector:

-- 1% < 5-min occupancy < 95% and

-- 1 < 5-min volume < 250

(4) Any detector malfunction is recorded in the disk file ALMREC and an alarm beep is sounded at the Dasher console.

AMODM

This program is activated every 10 min by the task program TRANSF to monitor data modem malfunction.

(1) It prints date and time information on the Dasher console.

(2) It checks data modem for malfunction from buffers MODEMT and MODEM, and records any malfunction for a maximum of 10 consecutive times for the same data modem to the disk file ALMREC.

(2.1) Specifically, the one-second modem response count error in the buffer MODEMT is checked.

(2.2) The modem address responses in the buffer MDMTMP, which are obtained from communication protocol 3, are checked for valid modem address in each corresponding buffer location.

(3) If a CMS data modem fails, "SIGN MODEM MALFUNCTION" is printed on Dasher console.

3.8/ Traffic Display Control Task Program

This task program controls the colour graphic terminal (Tektronix 4027) and provides a dynamic traffic display on the colour screen. Based on this real-time display, the operator can take any necessary actions --for example, he can zoom in the TV camera on a particular spot, phone the police, override the ramp metering cycle length or send traffic advisory messages to the changeable message signs. The programs required to control the colour graphic display terminal are described below.

(1) GMAP Program

This is the main 1 min traffic display control task program. It calls various subroutines to perform the following tasks:

(1.1) It suspends itself and waits for activation signal from the 30 s task program "TRANSF".

(1.2) It freezes the display if so commanded by the operator.

(1.3) It overlays subroutine "REQEW" to read the traffic display file "QEWDYN".

(1.4) It checks each entrance ramp for metering and then overlays subroutine "CHQOR" to check each entrance ramp for queue override.

(1.5) It overlays subroutine "ACCIDENT" to check the freeway station incident status.

(1.6) If the map to be displayed during the current minute differs from the previous one, or if a multiple of 60 minutes has elapsed, then it erases the terminal screen. It then opens the corresponding graphic polygon file for the map display requested by the operator. In addition to the main QEW corridor map (Appendix 1), there are six interchange maps. From west to east, they are: Ford Dr., Winston Churchill Blvd., Erin Mills Parkway, Mississauga Rd., Highway 10 and Cawthra Rd.

(1.7) If the operator requests the QEW corridor map, it displays heading, date, time and then follows steps 1.8 to 1.18. If the operator requests an interchange display, it goes to step 1.19 directly.

(1.8) If display colouring is by speed, it overlays subroutine "QSPD"; if by occupancy, it overlays "QOCC".

(1.9) It reads the QEW corridor graphic polygon file "QEWPOLY" to display bridges.

(1.10) It overlays subroutine "RAMPS" to display vectored ramps configuration.

(1.11) It overlays subroutine "DETECTOR" to display mainline detector stations.

(1.12) It then reads the rest of "QEWPOLY" to display the QEW corridor street network.

(1.13) If there is no incident, it goes directly to step 1.17.

(1.14) If an incident has been detected, it calls overlays subroutine "FACC" to obtain the first three incident locations.

(1.15) It overlays subroutine "FLASH" to write the graphic polygons for the incident location into a temporary file "TEMPFILE".

(1.16) It overlays subroutine "LOOP" to flash the incident location polygon on the colour graphic terminal screen by looping on "TEMPFILE".

(1.17) It then closes the "QEWPOLY" file.

(1.18) It then goes to step 1.31.

(1.19) It overlays subroutine "DISMAP" to initialize lane element, to determine number of mainline stations for display, to place heading, date and time.

(1.20) It overlays subroutine "SPD1" to determine what colour to paint the lane based upon the 1 min mainline lane speed data.

(1.21) It overlays subroutine "SPD2" to paint the driving lane and extra lane on the Winston Churchill interchange based on the traffic speed.

(1.22) It overlays subroutine "RAMPS" to colour the vectored ramps for the QEW corridor display and the ramp polygon for the interchange displays.

(1.23) It overlays subroutine "IOC1" to determine which colour to paint the interchange display lane if the display colour code option is based on 1 min mainline lane occupancy data.

(1.24) It overlays subroutine "IOC2" to paint the extra lane on the Winston Churchill interchange based on lane occupancy data.

(1.25) It overlays subroutine "RAMPS" to display interchange ramps as polygons.

(1.26) It overlays subroutine "BOX1" to read number of stations and controllers, to initialize speed, volume and occupancy elements, and to draw green boxes which contain the station speed, volume and occupancy value.

(1.27) It overlays subroutine "BOX2" to display mainline and ramp station speed, volume, and occupancy data.

(1.28) It overlays subroutine "BOX3" to display ramp metering cycle time for on-ramp and station 15A mainline data.

(1.29) It overlays subroutine "RDISMAP" to display miscellaneous polygons, detector stations, ramp metering arrows, colour code legend, textual data, and "North" direction pointer.

(1.30) It closes the interchange polygon file.

(1.31) It then goes back to step 1.1 waiting for task activation signal from "TRANSF" 1 min time slice later.

3.9/ Corridor Control and Surveillance Task Program

This task program is activated at one-minute intervals by the main task scheduling program. This task is reserved for future corridor control and surveillance.

3.10/ System Operator Control Command Function

The system operator control command function is accomplished by a set of overlay subroutines called by the TOPCOM program which is, in turn, called as the lowest priority program by the master task scheduling program QEW. Table 5 shows the seven command groups and the associated overlay subroutines.

An input editor routine, INPEDIT, is called by TOPCOM to accept and decode input commands. Depending on the command received, the control is passed to particular subroutines for action.

3.11/ System I/O Channel Usage Assignment

Table 6 describes the I/O channel usage assignments.

3.12/ System Parameter Definition

Table 7 defines the control parameters used in the QEW FSCS real-time control software system.

3.13/ QEW FSCS Program File Organization

The QEW FSCS real-time software system has 70 programs. The programs are stored as the disk files in three different formats. The source program file is identified by the suffix .SR (Assembler) or .FR (Fortran) and is used in the system development stage. The binary program file is identified by the suffix .RB and is generated by the compiler or assembler. The relocatable loader processes the binary files and generates the QEW save file "QEW.SV" and the QEW overlay file "QEW.OL" for execution purposes. When a system change is to be made, a source program is created or modified, then compiled, and loaded to create a new QEW save file and overlay file. Appendix 36 list the source programs comprising "QEW".

3.14/ QEW FSCS Data File Organization

The QEW FSCS real-time software system generates eight data files for system analysis purposes. Appendices 27 through 34 show, respectively, the DATA30, DATA5M, QEWDYN, INCLOG, ALMREC, XMTTAB, RESDEV, and WEATHER files' logical record format. Table 8 shows each file's structure.

The first physical record of each file is used to identify file name, date of file creation, physical record length, number of physical records per logical record, logical record length, and the number of physical records. Appendix 35 shows the first physical record format of each file.

In addition, there are four ramp metering operation support files. Table 9 shows each file's structure.

There are also two CMS message files and seven colour graphic polygon files.

4/ COMMAND DESCRIPTION

Traffic Control Command is the man/machine interface between the system operator and traffic control computer. The operator relies on this man/machine interface facility to effectively manage and control the freeway surveillance and control system (FSCS). To enhance this capability, a traffic control command definition meeting was held from 1978 10 25 to 1978 10 26 to review existing command performance and define new requirements. The following description is based on the past QEW FSCS experience expressed in the meeting.

Hierarchical Structure of Traffic Control Command

The Traffic Control Command will be represented by a three-level hierarchical tree structure. Figure 1 shows the first level of command structure.

QEW, the first-level on-line command, operates under the MRDOS environment, indicated by the prompt "R" (Ready).

QEW Command

Under the "QEW" command, there are eight command groups which constitute the second level command structure, shown in Figure 2.

These second-level commands operate under the QEW environment, i.e., under a real-time computer control environment, indicated by the prompt ">". To assist the operator identify each sub-command mode, pressing the CR (carriage return) key prints the sub-command name such as "RC", "QO", etc., on the console. To exit from any sub-command mode, typing "E" (Exit) returns to "QEW" mode. In addition, all the commands end with the CR key. A command escape character "$" (ESC key) is also available to abort any action command sequence and return the control to first-level command mode QEW.

4.1/ RC Second-level Command Group

Under "RC" second-level command, there are five action commands which are part of the third-level command structure. Figure 3 shows the third-level command structure under "RC".

(1) $CN_1N_2..N_iM\#$ Command

Format:

$C\ N_1\ N_2..\ N_i\ M\ \#$

The command line consists of command name "C" and "M" followed by arguments $N_1\ N_2..\ N_i$ and #, all separated by spaces.

Function:

The command is to override ramp controllers $N_1\ N_2..\ N_i$ with cycle length #. Where:

$N_1\ N_2..\ N_i$ = Controller identification number
# = Cycle length number

If only command name "C" is called for, then the cycle length of each ramp controller is displayed in an ascending order according to the controller identification number.

Example:

```
> C 2 3 10 M 4
```

The command overrides ramp controller 2, 3, and 10 with cycle length 4

```
> C
2 3 4 1 5 3 4 1 5 3
```

The cycle length of each controller is displayed.

(2) PN Command

Format:

P N

The command line consists of command name P and argument N, separated by space.

Function:

"P N" command is to change advancement of control period from automatic mode to manual mode or vice-versa. Where:

N = 0, 1, 2, or 3 indicate manually selected control period
  = 4 indicate a request for automatic advancement of control period

If only command name "P" is called for, then the present control period is displayed. If "CTRMOD" = 4, the output indicates "AUTO-ADVANCEMENT" instead of "MANUAL".

Example:

```
> P 3
```

To set ramp control period to 3.

```
> P
PRESENT CP = 3, MANUAL
```

To display present control period.

(3) $TN_1N_2N_3N_4$ Command

Format:

$T\ N_1\ N_2\ N_3\ N_4$

The command line consists of command name T and arguments N_1, N_2, N_3 and N_4, all separated by spaces.

Function:

"T" command is to change ramp control period start time frame.

Where:

N_1 = start time for control period 1
N_2 = start time for control period 2
N_3 = start time for control period 3
N_4 = start time for control period 0

If only command name "T" is called for, then all the control period time frames are displayed.

Example:

```
> T 655 715 815 900
```

To set the control period time frames to 6:55, 7:15, 8:15, and 9:00 for control period 1, 2, 3, and 0, respectively.

```
> T
CP START TIME:  655 715 815 900
```

To display control period time frames.

(4) R M N_0 N_1.. N_i Command

Format:

R M N_0 N_i.. N_i

The command line consists of command name R and arguments M, N_0, N_1, .., N_i, all separated by spaces. "i" value will depend on "M" value.

Function:

"R" command is to update the co-ordinated ramp control tables "RAMTAB", "CYCTAB", "CYCLES".

When: M = 1, the row elements of "RAMTAB" table will be updated

N_0 = the row number to be updated

N_1 N_2 N_3 N_4 = the new row element numbers

If only "R1" command is called for, then the 10 x 4 matrix element of "RAMTAB" will be displayed.

When: M = 2, the row elements of "CYCTAB" table will be updated

N_0 = the row number to be updated

N_1 N_2 N_3 N_4 N_5 = the new role element numbers

If only "R2" command is called for, then the 5 x 5 matrix element of "CYCTAB" will be displayed.

When: M = 3, the row elements of "CYCLES" will be updated

N_0 = the row numbers to be updated

N_1 N_2 N_3 N_4 N_5 = the new row element numbers

If only "R3" command is called for, then the 10 x 5 matrix element of "CYCLES" will be displayed.

Example:

```
> R 1 2 9 9 8 5
```

To update table "RAMTAB" row No. 2 with element 9, 9, 8, and 5

```
> R 2 3 50 60 66 78 87
```

To update table "CYCTAB" row No. 3 with element 50, 60, 66, 78, 87

```
> R 3 1 50 65 80 100 130
```

To update table "CYCLES" row No. 1 with element 50, 65, 80, 100, 130

(5) E Command

Format:

```
E
```

"E" command consists of command name E only.

Function:

"E" command is to exit from any second-level command mode and return to "QEW" command mode. The computer will print "QEW" on the console.

Example:

```
> E
QEW
>
```

4.2/ QO Second-Level Command Group

Under "QO" second-level command, there are seven action-commands which are part of the third-level command structure. Figure 4 shows the third-level command structure under "QO".

(1) N# Command

Format:

```
N #
```

"N" command consists of command name "N" followed by argument, #, separated by space.

Function:

"N" command is to enable ramp queue override logic on ramp No. #.

Example:

```
> N 3
```

To enable queue override logic on ramp No. 3.

(2) D# Command

Format:

```
D #
```

"D" command consists of command name "D" and argument, #, separated by space.

Function:

"D" command is to disable ramp queue override logic on ramp No. #.

Example:

```
> D 10
```

To disable queue override logic on ramp No. 10.

(3) L $N_1N_2 .. N_{10}$ Command

Format:

L N_1 N_2 .. N_{10}

The command line consists of command name L and arguments N_1, N_2, .., N_{10}, all separated by spaces.

Function:

"L" command is to update lower-bound Q-OCC threshold values on all 10 ramps in terms of number of pulses.

Where:

N_1 N_2 .. N_{10} = lower-bound values for 10 on-ramps

Example:

```
> L 600 600 600 600 600 600 600 600 600 600.
```

(4) U $N_1N_2..N_{10}$ Command

Format:

$U\ N_1\ N_2\ ..\ N_{10}$

The command line consists of command name U and arguments, N_1, N_2, .., N_{10} separated by spaces.

Function:

"U" command is to update upper-bound Q-OCC threshold values on all 10 ramps in terms of number of pulses.

Where:

$N_1\ N_2\ ..\ N_{10}$ = upper-bound values for 10 on-ramps

Example:

```
> U 1050 1050 1050 1050 1200 1050 1050 1050 900 900
```

(5) $TMSN_1N_2\ ..\ N_{10}$ Command

Format:

$T\ M\ S\ N_1\ N_2\ ..\ N_{10}$

The command line consists of command names T and S, and arguments M and N_1, N_2, .., N_{10}, all separated by spaces.

Function:

The command is to set queue override time limit, M, before steady green and number of 30 s time step, N, during cycle length reduction process.

Where:

M = time limit in minutes

$N_1\ N_2\ ..\ N_{10}$ = number of 30 s time step for all ten on-ramps

Example:

```
> T 20 S 6 6 6 6 6 6 6 6 6 6
```

To set queue override time limit to 20 min before steady green and time step to 3 min for all ten on-ramps.

(6) P Command

Format:

P

The command line consists of command name "P" only.

Function:

"P" command is to print out common buffer related to metering strategy and queue override strategy.

Example:

```
> P
--------------------------------------------------------------------------
            RAMPS
--------------------------------------------------------------------------
            No.1  No.2  No.3  No.4  No.5  No.6  No.7  No.8  No.9  No.10
--------------------------------------------------------------------------
MODCYC         5     5     5     5     5     5     5     5     5     5
QWAIT          0     0     0     0     0     0     0     0     0     0
QOVER          1     0     0     0     0     0     0     0     0     0
QOCCLB       600   600   600   600   600   600   600   600   600   600
QOCCUB      1050  1050  1050  1050  1200  1050  1050  1050   900   900
QOCC          34   123    50    12   100   152    79    85    93    49
--------------------------------------------------------------------------
```

(7) **E Command**

Same as Section 4.1 (5)

3.2/ CMS Second-Level Command Group

Under "CMS" second-level command, there are seven action-commands which are part of the third-level command structure. Figure 5 shows the third-level command structure under "CMS".

(1) **A Command**

Format:

A

The command line consists of command name "A" only.

Function:

"A" command is to add a message to the message file "MSGFILE", assigning the first available number to it.

<u>Example</u>:

```
> A
ROW 1, CR, ROW 2, CR
1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2
      I N C I D E N T  A H E A D
  D R I V I N G  L A N E  B L O C K E D
OK?
> Y
MSG No. 23
      I N C I D E N T  A H E A D
  D R I V I N G  L A N E  B L O C K E D
>
```

(2) B Command

<u>Format</u>:

```
B
```

The command line consists of command "B" only.

<u>Function</u>:

"B" command prints the contents of the message transmit and receive buffers.

<u>Example</u>:

```
>  B
TRANSMIT MESSAGE:
MAINTENANCE OPERATIONS
   CENTRE LANE CLOSED
RECEIVE MESSAGE:
MAINTENANCE OPERATIONS
   CENTRE LANE CLOSED
```

(3) D# Command

<u>Format</u>:

```
D #
```

The command line consists of command name "D" and argument #, separated by space.

Function:

"D" command is to delete message number "#" from the message file.

Example:

```
> D 23
```

To delete message No. 23

(4) L Command

Format:

```
L
```

The command line consists of command name "L" only.

Function:

"L" command is to list all messages transmitted from table file "XMTTAB". The messages are listed in ascending order of CMS controllers and times.

Example:

```
> L
CMS 1.
7:50:30
MAINTENANCE OPERATIONS
   CENTRE LANE CLOSED
8:15:00
ACCIDENT AHEAD
RIGHT LANE CLOSED
CMS 2.
7:45:00
CONGESTION AHEAD
REDUCE SPEED
```

(5) S N M # Command

Format:

```
S N M #
```

The command line consists of command name "S" and "M" followed by arguments N and #, all separated by spaces.

Function:

"S" command sends message "#" to the sign controller with identification number N.

If only command name "S" and argument N are called for, then the latest message transmitted to that sign controller shall be displayed.

Example:

```
> S 1 M 3
FREEWAY OPEN
DRIVE CAREFULLY
```

This command sends message 3 to sign controller 1.

```
> S 1
FREEWAY OPEN
DRIVE CAREFULLY
```

This command displays the latest message transmitted to the sign controller 1.

(6) P # Command

Format:

P #

The command line consists of command name "P" and argument "#", separated by space.

Function:

"P" command prints message number "#"

Example:

```
> P 5
MESSAGE No. 5
MAINTENANCE OPERATIONS
   CENTRE LANE CLOSED
```

(7) E Command

Same as Section 4.1 (5)

4.4/ G Second-Level Command Group

Under "G" second-level command, there are nine third-level action commands. Figure 6 shows the third-level command structure under "G". The "G" command group is to change graphic displays.

(1) Q, F, W, S, M, H, C, N, E, O, V Commands

Format:

Q

The command line consists of a single command name Q only. This format applies to all other commands F,W,S,M,H,C,N,E,O,V.

Function:

Same as described in Figure 6.

Example:

```
> F
```

To display Ford Drive interchange map.

4.5/ INF Second-Level Command Group

Under "INF" second-level command, there are five third-level commands. Figure 7 shows the third-level command structure under "INF". The "INF" command group is to retrieve traffic flow information and to modify incident detection threshold values.

(1) I $M_1M_2N_1N_2N_3N_4$ Command

Format:

I M_1 M_2 N_1 N_2 N_3 N_4

The command line consists of command name I, and arguments M_1, M_2, N_1, N_2, N_3, N_4, all separated by spaces.

Function:

The "I" command is to modify the incident detection threshold values, to verify, to enter or to retrieve traffic incident information.

Where:

M_1 M_2 = The range of the mainline detector station number

N_1 N_2 N_3 N_4 = The corresponding incident detection threshold values

If only command "I M_1 M_2" is called for, where $M_1 = M_2$, then the traffic controller will verify the traffic incident information at detector station "M_1", as reported by the computer. If $M_1 \neq M_2$, and $M_2 = 0$, then the traffic controller will enter the true incident information not reported by the computer. If $M_1 < M_2$, then the traffic incident information from the detector station number M_1 to M_2 will be displayed.

Example:

```
> I 5 5 10 46 17 20
STATION 5 THRESHOLD:  10 46 17 20
> I 7 7
STATION LANE   BEGIN   END
     7    P    8:15:30   -     ---- Computer output
     7    P    8:14:00   -     ---- Traffic controller input for true
                                    incident
or   -    -      -       -     ---- Traffic controller input for inci-
                                    dent status which cannot be veri-
                                    fied
or   0    0      0       0     ---- Traffic controller input for false
                                    incident reported by the computer

> 1 7 0
STATION LANE   BEGIN   END
     7    P    8:14:00 8:20:00 --- Traffic controller input for true
                                    incident not detected by the
                                    computer
```

```
> I 4 11
DATE:  1978-11-23  WEATHER:  RAINY
QEW FREEWAY INCIDENT SUMMARY
STATION LANE   BEGIN     END        MAX. MAINLINE Q DN/VOL VERIFIED
     5    P   8:20:20  8:30:00           3          4 000    YES
    10    C   8:45:00  9:00:00           7          3 500    NO
```

(2) D N_1 N_2 Command

Format:

D N_1 N_2

The command line consists of command name D, and agruments N_1 and N_2, all separated by spaces.

Function:

"D" command is to retrieve 5 min detector volume and occupancy data.
Where:

N_1 = first detector number
N_2 = last detector number

Example:

```
> D 66 70
1978-11-23  7:5:0
5 min DETECTOR DATA

--------------------------------------------------------
DETECTOR                    VOLUME          OCCUPANCY %
--------------------------------------------------------
   66                        120                 19
   67                        121                 20
   68                        135                 25
   69                        118                 14
   70                        150                 28
--------------------------------------------------------
```

(3) S N_1 N_2 Command

Format:

S N_1 N_2

The command line consists of command name S, and arguments N_1 and N_2, all separated by spaces.

Function:

The "S" command is to retrieve 30 sec mainline speed data.

Where:

N_1 = first detector station number
N_2 = last detector station number

Example:

```
S 2 4
1978-11-23   7:10:30
30 s MAINLINE SPEED DATA IN km/h
```

STATION	DL	CL	PL	AVE
2	40	50	60	50
3	30	40	50	40
4	20	30	40	30

(4) V N_1 N_2 Command

Format:

V N_1 N_2

The command line consists of command name V, and arguments N_1 and N_2, all separated by spaces.

Function:

The "V" command is to retrieve 5 min truck and passenger car volume count, where:

N_1 = first detector station number
N_2 = last detector station number

Example:

```
> V 6 7
1978-11-23  8:5:0
5 min TRUCK AND CAR COUNT
----------------------------------------------------------------
 STATION        TRUCK            CAR           SUM        TRUCK %
----------------------------------------------------------------
    6             20             130           150           13
    7             20             140           160           12
----------------------------------------------------------------
```

(5) E Command

Same as Section 4.1 (5).

4.6/ H Second-Level Command Group

Under "H" second-level command, there are 12 third-level action commands. Figure 8 shows the third-level command structure under "H". The "H" command group is to monitor and control hardware operation.

(1) BA, BN, BD Command

Format:

```
BA or BN or BD
```

These commands have the same format. The command line consists of command name BA, BN, or BD.

Function:

BA command is to enable all "BEEP" sounds

BN command is to silence individual "BEEP" sounds

BD command is to disable all "BEEP" sounds

Examples:

```
> BA
> BN
> BD
```

(2) C N_1 N_2 Command

Format:

`C N1 N2`

The command line consists of command name C, and arguments N_1, N_2, all separated by spaces.

Function:

The "C" command is to enable ramp controllers, where:

N_1 = first ramp controller identification number

N_2 = last ramp controller identification number

Example:

```
> C 3 8
```

To enable ramp controllers No. 3 to No. 8

(3) D N_1 N_2 Command

Format:

`D N1 N2`

The command line consists of command name D, and arguments N_1, N_2, all separated by spaces.

Function:

The "D" command is to enable loop detectors, where:

N_1 = first loop detector number

N_2 = last loop detector number

Note:

Detectors west of the O.P.P. trailer (numbered 1 through 148) must be enabled separately from those east of the trailer (numbered 501 through 532).

Example:

```
> D 43 48
```

To enable loop detectors No. 43 to No. 48.

(4) K N_1 N_2 Command

Format:

K N_1 N_2

The command line consists of command name K, and arguments N_1 and N_2, all separated by spaces.

Function:

The "K" command is to disable loop detectors, where:

N_1 = first loop detector number

N_2 = last loop detector number

Note:

Detectors west of the O.P.P. trailer (numbered 1 through 148) must be disabled separately from those east of the trailer (numbered 501 through 532).

Example:

```
> K 35 49
```

To disable loop detectors No. 35 to No. 49.

(5) L N_1 N_2 Command

Format:

L N_1 N_2

The command line consists of command name L, and arguments N_1, N_2, all separated by spaces.

Function:

"L" command is to enable ramp metering signal lights, where:

N_1 = first ramp metering signal light number

N_2 = last ramp metering signal light number

Example:

```
> L 2 8
```

To enable ramp metering signal lights No. 2 to No. 8

(6) M N_1 N_2 Command

Format:

M N_1 N_2

The command line consists of command name M, and arguments N_1, N_2, all separated by spaces.

Function:

The "M" command is to enable the data modem, listed in Appendix 12, where:

N_1 = first data modem address in octal, between 000(8) and 223(8)

N_2 = last data modem address in octal, between 000(8) and 223(8).

Example:

```
> M 10 17
```

To enable data modem addresses 10(8) through 17(8).

(7) SE, SD Command

Format:

SE or SD

These commands have the same format. The command line consists of command name SE or SD.

Function:

SE command is to enable both changeable message signs.

SD command is to disable both changeable message signs.

Example:

```
> SE
> SD
```

(8) PN Command

Format;

P N

The command line consists of command name P, and arguments N separated by space.

Function

The "P" command is to output hardware error report, where:

N = 1, to output detector error report
N = 2, to output ramp controller error report
N = 3, to output ramp metering signal light error report
N = 4, to output data modem error report
N = 5, to output changeable message sign error report

If only command "P" is called for, then all hardware error reports will be displayed.

Example:

```
> P 1
LOOP DETECTORS:
57 59 61 63 65 67
> P 2
RAMP CONTROLLERS:
1 4 5
> P 3
SIGNAL LIGHTS:
4 5
> P 4
DATA MODEMS:
36 37 44
> P 5
CHANGEABLE MESSAGE SIGNS:
1
```

(9) E Command

Same as Section 4.1 (5)

4.7/ JCW Second-Level Command Group

Under "JCW" second-level command, there are 13 third-level action commands. Figure 9 shows the third-level command structure under "JCW". The "JCW" command group is to monitor and control computer system operation.

(1) A N_1 N_2 N_3 Command

Format:

A N_1 N_2 N_3

The command line consists of command name "A", and arguments N_1, N_2, N_3, all separated by spaces.

Function:

The "A" command is to modify ramp controller modem address, where:

N_1 = first ramp controller identification number
N_2 = last ramp controller identification number
N_3 = ramp controller modem address (in decimal) for controllers No. N_1 to No. N_2

Example:

```
> A 1 10 0
```

To set all 10 ramp controller modem addresses to zero.

(2) DI Command

Format:

DI

The command line consists of command name "DI".

Function:

The "DI" command is to disable the CONTROL A console interrupt mechanism.

Example:

```
> DI
CTRL A INTERRUPT DISABLED.
```

(3) EN Command

Format:

EN

The command line consists of command name "EN".

Function:

The "EN" command is to enable the CONTROL A console interrupt mechanism.

Example:

```
> EN
CRTL A INTERRUPT ENABLED
```

(4) F Command

Format:

F

The command line consists of command name F.

Function:

The "F" command is to exit from the real-time QEW software system and return control to MRDOS.

Example:

```
> F

    ------------------------------------------
    Files                              Records

    ------------------------------------------
    DATA30                               147
    DATA5M                                22
    INCLOG                                 2
    RAMDAT                                50
    ALMREC                                12
    XMTTAB                                 2
    QEWDYN                               147
    RESDEV                                 2
    ***QEW SYSTEM SHUT DOWN***
    ------------------------------------------

R
```

(5) D Command

Format:

D

The command line consists of command name D.

Function:

The "D" command is to display on the line printer 60 consecutive seconds of detector buffer contents received via protocol 1.

Warning:

This command executes very slowly, preventing further operator input for about 10 minutes!

(6) T Command

Format:

T

The command line consists of command name T.

Function:

The "T" command is to display the current time and date.

Example:

```
> T
1978-11-1  8:43:38
```

(7) M Command

Format:

M

The command line consists of command name M only.

Function:

The "M" command is to print the data modem echo test result.

(8) PN Command

Format:

PN

The command line consists of command name P and argument N, separated by space.

Function:

The "PN" command is to activate protocols 1, 2 and 3 or 4 and 5, where:

N = 1, to activate protocols 1, 2, and 3
N = 2, to activate protocols 4 and 5

If only command "P" is called for, then the protocol information between the traffic control computer and the communication processor is displayed.

Note: This command is not yet implemented. Instead, use the stand-alone program DMATST, listed in Appendix 37.

(9) S N_1 N_2 N_3 Command

Format:

S N_1 N_2 N_3

The command line consists of command name "S" and arguments N_1, N_2, N_3, all separated by spaces.

Function:

The "S" command is to modify the sign controller identification numbers, where:

N_1 = First sign controller identification number
N_2 = Last sign controller identification number
N_3 = Sign controller identification number for controller number N_1 to number N_2.

Example:

```
> S 1 2 0
```

To set sign controller numbers 1 and 2 to zero.

(10) W Command

Format:

W

The command line consists of command name W only.

Function:

The "W" command is to update the initial environmental conditions.

Example:

```
> W
ENTER CONDITIONS:
  WEATHER    > RAINY
  PAVEMENT   > WET
  VISIBILITY > POOR
```

(11) Y Command

Format:

`Y`

The command line consists of command name Y only.

Function:

The "Y" command displays loop detector out-of-range errors.

(12) Z Command

Format:

`Z`

The command line consists of command name Z only.

Function:

The "Z" command displays the ramp controller command output buffer in binary.

(13) E Command

Same as Section 4.1 (5)

4.8/ X Second-Level Command Group

The X second-level command group is a reserved command module. It will implement new commands when they become necessary at a later date.

4.9/ System Handshake Dialogue

After the QEW command, the system will initiate the following hand-shake dialogue with the user:

```
> QEW
DO YOU WANT A COLD START?  (Y/N) > Y
ENTER CONDITIONS:
  WEATHER     > CLEAR
  PAVEMENT    > DRY
  VISIBILITY  > GOOD
*WELCOME TO QEW SURVEILLANCE AND CONTROL PROJECT*
*COURTESY OF SYSTEMS RESEARCH - MTC             *
*TODAY'S DATE:  83/08/29      TIME:  6:45:0     *
```

A "cold" start creates a fresh set of eight output data files; a "warm" start restores the previous set of files, and appends the new data to these existing files.

4.10/ System Performance Evaluation Commands

At the end of QEW control software operation, the following commands are available to evaluate QEW freeway system performance.

(1) RPT Command

This command will generate four 5-minute reports on the line printer: ramp station occupancy and volume, and mainline station occupancy and volume.

(2) CONTOUR Command

This command will generate a traffic speed contour diagram on the 4027 Tektronix colour graphic terminal. A hardcopy is also available under this command.

(3) TTM Command

This command will generate travel time diagram for various sections of the freeway on the 4027 Tektronix colour graphic terminal. A hardcopy is also available under this command.

5/ OPERATING PROCEDURES

5.1/ Operating Procedure for DG NOVA 4/X Mini-Computer

This document is stored in disk file DPO:CHAN:DGPROC.LS on the NOVA.

(1) BRINGING UP THE SYSTEM

1/ Power on Dasher console. Hit VIEW, ON-LINE, and ALPHA LOCK keys- (should light up).
2/ Power on disk drive. Press LOAD/READY switch to READY.
3/ When READY light on, power on NOVA CPU.
4/ Press rocker switch to RESET, then PR(ogram) LOAD.
5/ To "FILENAME?" prompt, type DPOF:PCSSYS cr (cr=Carriage Return)
6/ Enter current date and time.
7/ Type CLEAR/A/V cr, then ON cr.

(2) USING THE LINE PRINTER

1/ Power on line printer (two breaker switches lower front right).
2/ To position paper at top of form:
   a) Press ON/OFF-LINE button OFF.
   b) Press TOP OF FORM button. Raise cover.
   c) Open gate with silver lever below switch pod.
   d) Holding FORM RESET switch, turn vertical knob until perforations on paper are 1/2 inch above print line.
   e) Close gate and cover.
3/ Press ON/OFF-LINE button OFF.
4/ To change paper:
   a) Press ON/OFF-LINE button OFF.
   b) Raise cover, open gate, and flip open covers on each side over tractor mechanism.
   c) Insert paper from underneath. Ensure paper holes fit sprockets and then close covers.
   d) Follow paper positioning instructions in 3 above.

(3) USING THE TAPE DRIVE

1/ Power on drive.
2/ Open cover. Mount tape on lower hub.

3/ Thread tape as per diagram on inside of cover.

4/ Wind several turns of tape on upper hub.

5/ Depress RESET, LOAD, and ON-LINE switches.

6/ To remove a tape, depress the RESET switch, then the REWIND switch. Once the tape has rewound, press and hold the UNLOAD switch until the tape is fully wound on the lower hub.

(4) USING THE TEKTRONIX 4027 TERMINAL

1/ Power on the terminal (switch on lower right, front side).

2/ Hit TTY LOCK and COMMAND LOCK-OUT keys (should light up).

3/ On the console, type DIR DPOF cr, then SMEM 51 cr, then EXFG/E CLI cr.

4/ The terminal will now function as a NOVA foreground terminal.

5/ Before running any graphic programs, make sure the COMMAND LOCK-OUT light is off.

6/ Using Tektonix 4027 text editing with the NOVA:

- a) Set up 4027 as foreground terminal (steps 1-3 above).
- b) Make sure COMMAND LOCK-OUT light is off.
- c) Type !WOR 30 K cr;
- d) Now key in text as you like but make sure first line is of the form XFER/A TTI1 ANYFILE.
- e) When you have finished, type !SEN cr, then !MON 34 H cr.
- f) Screen will erase. Then hit COMMAND LOCK-OUT and CTRL-Z keys.

(5) RUNNING THE QEW PROGRAM

1/ Check that the BDCSP communication program is running.

2/ After bringing up the system, type DIR CHAN cr.

3/ If foreground not running, then type CLEAR/A/V cr.

4/ Type QEW cr and answer the prompts.

5/ The program remains idle until an even multiple of 5 minutes (e.g., 6:10, 7:25) is reached.

6/ As the program runs, enter commands as desired. To abort the program, hit the CTRL-A key.

7/ To finish the program, type JCW cr, then F cr.

(6) TAKING DOWN THE SYSTEM

1/ If foreground running:
   a) On the terminal, type OFF cr.
   b) On the console, hit CTRL-F key.
2/ Power off the Tektronix terminal.
3/ Type OFF cr.
4/ If leaving over several days (e.g., weekend):
   a) Type RELEASE DPOF cr.
   b) Press the disk LOAD/READY switch to LOAD.
   c) When LOAD lights up, power off the disk drive.
   d) Power off the NOVA CPU and the Dasher console.

5.2/ Operating Procedure for the HP 21MX Mini-Computer

This document is stored in DPO:CHAN:HPPROC.LS on the NOVA.

1/ Power on the floppy disk drive.
2/ Insert floppy diskette into drive.
3/ Power on HP, turn key to OPERATE, and press HALT.
4/ Store the appropriate number into the B register.
   i) For the QEW cable network program load the "MTC ABS" value shown on the diskette.
      a) To run the "DMA DIAGNOSTIC", load the "MTC ABS" program and let run. Then "HALT" and load the diagnostics start address into the P register. This address can be found in the MTC Traffic Control System, Section 8.

   ii) To load the "ISI TDM/FDM Test Program" enter the "TESTA" value shown on the diskette into the B register. Instructions regarding this program may be found in the MTC Traffic Control System under the heading "MTEST".
5/ Enter octal 141600 (bits 7,8,9,14,15) in the S register.
6/ Press IBL, PRESET, and RUN.
7/ Remove diskette from drive.
8/ Power off drive.

*** WARNING ***

NEVER POWER ON OR OFF THE DISKETTE DRIVE WHILE A DISKETTE IS STILL WITHIN!!!

6/ FINE TUNING

The QEW control software provides the facility to fine tune the control system parameters so that a satisfactory operating condition can be achieved.

6.1/ Adjustment of Ramp Control System Parameters

Depending on the changing recurrent congestion condition at the geometric bottleneck, the four-ramp control period start time frame can be changed by the operator command $TN_1N_2N_3N_4$. For example, when the recurrent congestion period is lessened, the ramp control period can be shortened. On the other hand, if the recurrent congestion period becomes longer, the ramp control period can be lengthened. The three-ramp control tables CYCLES, RAMTAB, and CYCTAB have been expanded to accommodate the three new interchanges. Command $RMN_0N_1...N_I$ shall be used to update the CYCLES table to include the new ramp controller's local cycle length in deci-second units (for example, 60 represents 6.0 s). The cycle length in the CYCLES is grouped according to the sequence of Cawthra N/B ramp, Cawthra S/B ramp, Highway 10 N/B ramp, Highway 10 S/B ramp, Mississauga N/B ramp, Mississauga S/B ramp, Southdown ramp, Winston Churchill N/B ramp, Winston Churchill S/B ramp, Ford Drive ramp.

The upstream station, local station, downstream station, and the control section assignment for each ramp will also be updated in the RAMTAB table. The detector station assignment in the RAMTAB is also grouped in the same sequence as CYCLES. The assignment in RAMTAB table will allow various co-ordinated ramp control strategies to be implemented. The ramp control can be made responsive to one, or more than one, geometric bottleneck(s). For example, if the bottleneck is at station 19 which is between Highway 10 and Cawthra Road interchange, the upstream ramp's downstream station can be assigned 19 and the downstream ramp's upstream station can be assigned 20. In this way, the ramp control system will take the bottleneck congestion status into account. The ramp control system can also respond to the traffic incident automatically. For example, when an incident occurs, the downstream ramp will allow more vehicles to enter the mainline freeway and the upstream ramp will allow fewer vehicles to enter the freeway. The 1 min station occupancy threshold value in CYCTAB shall be adjusted to reflect the new vehicle detector signal sampling rate of 25 samples per second. For example, 1% occupancy shall be represented by 45, and at a four-lane freeway station, 1% occupancy shall be represented by 60.

6.2/ Adjustment of Ramp Queue Override Control Parameters

Due to the difference in ramp storage capacity, ramp queue detector location, and ramp demand, each ramp queue override upper-bound and lower-bound occupancy threshold value shall be adjusted by the commands $LN_1N_2..N_{10}$ and $UN_1N_2..N_{10}$. The difference in the upper-bound and lower-bound values shall be wide enough to allow for stable ramp queue override operation. The upper-bound threshold shall be set to a value corresponding to the maximum allowable queue length. The lower-bound threshold may be set to a value between 40% to 80% of the upper-bound threshold. A correlation study of the ramp queue length and ramp queue detector occupancy for each ramp is recommended for fine tuning purposes. The fine tuned threshold values can then be updated in the next version of software.

6.3/ Adjustment of Incident Detection System Parameters

Recognizing the effect of geometric difference and traffic condition variation on the incident detection system performance, each incident detection station is provided with its own set of threshold parameters which can also be adjusted by the command $IM_1M_2N_1N_2N_3N_4$.

There are four threshold parameters provided for each incident detection station. The first threshold parameter is the station occupancy threshold and is to ensure that the incident detection algorithm operates above the low-density traffic flow condition. The purpose is to reduce the incidence of unnecessary false alarms. It can be de-activated by setting it to zero. Normally, it can be set at 8% to 10%.

The second threshold parameter is the occupancy difference between the two adjacent stations. The purpose of this parameter is to ensure that the execution of the algorithm will proceed only if there is substantial occupancy difference existing between the two adjacent stations. It also helps to clear an incident condition. This parameter can be used when the first threshold parameter is set to zero. It can also be de-activated when set to zero.

The third parameter is the relative percentage occupancy difference between the two adjacent stations. This parameter is to detect the presence of a traffic flow space discontinuity due to incident. This parameter can be adjusted by observing the test value under incident condition and no incident condition. The parameter may be sensitive to geometric variation, e.g., when the station is near an on-ramp or off-ramp, or when the station is near the location where the number of lanes changes.

The fourth parameter is the relative percentage occupancy difference between two subsequent time intervals of a station. This parameter is to detect the passage of the shock wave (time discontinuity) over the detector station and is to distinguish between the incident and gradual change in traffic density due to demand change. This parameter can also be adjusted by observing the test value under incident and no incident conditions. Values of 46% for the third parameter and 17% for the fourth parameter have been found satisfactory for certain detector stations. A two- to three-month calibration period may be required when fine tuning a new system.

There are some slight variations in the QEW incident detection algorithm when compared with the California algorithm. These variations were introduced after testing the incident detection system in the QEW FSCS. It was found that the change is required because the QEW FSCS is not operated at the optimum flow condition all the time; instead, it operates at balanced delay condition. When the system operates at the balanced delay condition, the mainline queue may still occur from time-to-time.

It is also believed that the recent improvement in the QEW corridor arterial routes and the recently-opened Highway 403 will reduce the congestion on the QEW. There is a possibility that the QEW FSCS can then be operated at optimum flow condition. In this case, the existing incident detection algorithm may have to be adjusted or modified.

6.4/ Adjustment of Detection Hardware Monitoring Parameters

As described in Section 3, the detector hardware monitoring parameters are incorporated in the control software data section. The need for the adjustment of the detector hardware monitoring parameters may arise when there is wide variation of the traffic flow condition. Continuing monitoring of the hardware monitoring parameters and the traffic flow condition is needed to ensure satisfactory system operation.

6.5/ Generation of Changeable Message Sign Messages

Due to the demonstration nature of the QEW changeable message signs, the control software is equipped with the commands to generate, save and to send messages to the sign. The number of messages which can be stored in the system is limited only by the available disk capacity. Thus, if necessary, thousands of messages can be stored in the system to deal with different traffic conditions. Automatic selection and display of the message according to the traffic condition is not a requirement in the QEW demonstration system. However, this feature can be implemented when the criteria for automatic control are finalized.

6.6/ Explanation of Colour Graphic CRT Traffic Status Display

To inform the operator of the real-time traffic status, a colour graphic CRT is utilized to display the freeway and traffic in graphic symbols and colour codes. Each detector station is shown in white on a black background. The mainline freeway section bounded by two detector stations is coloured green if the upstream detector station occupancy is less than 20%. It is coloured yellow if the occupancy is between 20% and 30%. It is coloured red if the occupancy is greater than 30%. When the speed data are selected for the colouring option, the following colour code is used:

- greater than 100 km/h -- blue
- 80 to 100 km/h -- green
- 60 to 80 km/h -- yellow
- 40 to 60 km/h -- cyan
- less than 40 km/h -- red

The interchange on-ramp is coloured according to the following convention:

- Green -- the ramp is not in queue override condition.
- Yellow -- the ramp is in queue override condition, but queue detector occupancy is below upper-bound threshold value.
- Red -- the ramp is in queue override condition, but queue detector occupancy is above upper-bound threshold value.

When an incident is detected in a freeway mainline section, the colour will flash for approximately 10 s to notify the operator.

7/ REFERENCES

[1] Preliminary Operating and Service Manual -- Micro Controller CR710 Ramp Metering Controller. Traffic Data System.

[2] Traffic Signal Control Equipment Specifications, Traffic Engineering Office, Ontario Ministry of Transportation and Communications, Downsview, Ontario.

[3] "Development of Freeway Incident Detector Algorithms by using Pattern Recognition Techniques," TRB, Transportation Research Record 722, 1980, pp. 113 - 116.

[4] NOVA 4/X Computer System Description -- Hardware and Software Documents, Data General, 1978 Mass., U.S.A.

[5] "Specification for Cable Network Hardware and Software for QEW Expressway Traffic Control System," IS/3M, Ann Arbor, U.S.A., 1980.

[6] "QEW FSCS NOVA 4/X Real-Time Traffic Control Program Listing," Control Systems R & D, MTC, 1980.

[7] "QEW FSCS Surveillance and Control Program HIPO Software Description," Control Systems R & D, MTC, 1980.

[8] "Real-Time Programmers Guide Graphics Software for NOVA 4/X Computer," Control Systems R & D, MTC, 1981.

[9] "Traffic Control Command Language Interpreter Program Description," Control Systems R & D, MTC, 1981.

Table 1/ Maximum Controllable Cable Length

BAUD RATE (Bit/s)	48 000	24 000	12 000
Controllable cable length before modification (km)	9.6	19.2	38.4
Controllable cable length after modification (km)	32	64	128

Table 2/ Loop Centre to Loop Centre Distances (in Metres)

Station	Driving Lane	Centre Lane	Passing Lane
1	5.5	5.3	5.6
2	5.9	6.1	6.1
3	6.1	6.1	6.1
4	6.1	6.2	5.9
5	6.1	6.1	6.2
6	6.1	5.8, 6.1	6.1
7	6.0	6.1	6.2
8	6.1	6.1	5.9
9	8.2	8.4	8.1
10	6.1	6.1	6.1
11	6.1	6.1	6.1
12	6.4	6.4	6.4
13	6.1	6.1	6.1
14	5.5	5.5	5.5
15	4.0	3.7	3.7
16	6.1	6.1	6.1
17	5.5	5.5	5.5
18	7.0	6.1	6.1
19	6.2	6.1	6.2
20	6.1	6.3	6.4
21	5.6	6.0	5.9
22	5.8	6.0	5.9

Table 3/ CR 710 Ramp Controller Interface Assignment

8-Status Bits to Traffic Control Computer

Bit	Function
0	Occupancy status
1	Cycle length status
2	Cycle length status
3	Cycle length status
4	Demand pretimed
5	Passage pretimed
6	Spare
7	Spare

8-Command Bits to CR710

Bit	Function
0	Hold on line (HOL)
1	Cycle length command
2	Cycle length command
3	Cycle length command
4	Demand pretimed
5	Passage pretimed
6	0-1st message address
7	0-1st message address

Table 4/ Type 170 -- Remote Ramp Control Command Definition

Bit	Function
1	Rate Code (1)
2	Rate Code (2)
3	Rate Code (4)
4	Rate Code (8)
5	HOL
6	0
7	Command is for ramp 2, if equal to "1"
8	Command is for ramp 1, if equal to "1"

(where rate code (bit 1 to bit 4) indicates the metering rate required by the traffic control computer)

Table 5/ Operator Command Function and Overlay Subroutines

Command Groups	Functions	Subroutines
RC	To change ramp control operation	...T12A,B
QO	To modify queue occupancy override logic	...T13
CMS	To operate changeable message signs	...T14A,B,C,D
G	To change graphic displays	...T15
INF	To retrieve traffic flow information	...T16A,B,C,D
H	To monitor and control hardware operation	...T17A,B
JCW	To monitor and control system operation	...T18A,B,C,D

Table 6/ Traffic Control Computer I/O Channel Usage

Channel #	Used by Routine (Task)*	For File Name
1	(QEW), (TRANSF) (GMAP)	QEW.OL
2	INITIALIZE (QEW)	DMPREC
	INITIALIZE (QEW)	XMTTAB
	HEADING (QEW)	WEATHER
3	UPD30S (TRANSF)	DATA30
	UPD30S (TRANSF)	DATA5M
	INCDET, VTLU (TRANSF)	INCLOG
	DIS1, DIS2 (TRANSF), (GMAP)	QEWDYN
	DIS2 (TRANSF)	DMPREC
	DIS2 (TRANSF)	CYCLES
	CLDU, VTLU (TRANSF)	RESDEV
5	RCTIME (TRANSF)	RAMTAB
	RCTIME (TRANSF)	CYCTAB
	QUOCC (TRANSF)	QUETAB
6	TP12B (QEW)	RAMTAB
		CYCTAB
		CYCLES
	TP14A, TP14B, TP14C (QEW)	MSGFILE
	TP14A (QEW)	PARTAB
	TP14B, TP14C, TP18C (QEW)	XMTTAB
	TP16B, TP16C, TP18C (QEW)	INCLOG
	TP16D, TP18C (QEW)	DATA30
		DATA5M
	TP18B, TP18C (QEW)	WEATHER
	TP18C (QEW)	ALMREC
	TP18C (QEW)	QEWDYN
	(GMAP)	4027 I/P
7 (RO)	QSPD, QOCC (GMAP)	QPOLY
	DETECTOR, LOOP (GMAP)	FORDPOLY
		WINPOLY
	DISMAP, RDISMAP, SPD1, SPD2 (GMAP)	ERINPOLY
	IOCC, IOC2, RAMPS, BOX1 (GMAP)	MISSPOLY
		HWYPOLY
	BOX2, BOX3 (GMAP)	CAWPOLY
	(GMAP)	4027 O/P
8	ALM30S, ALM5M, AMODM (TRANSF)	ALMREC
	ALM5M (TRANSF)	DATA5M
	DATSTR, CLDU (TRANSF)	DATAX

Table 6/ (Continued)

Channel #	Used by Routine (Task)*	For File Name
9 (RW)	FLASH, LOOP (GMAP)	TEMPFILE
10	PASSWORD, TOPCOM, HEADING (QEW) DATAIN (COMCOM), TP14D, INPEDIT, TP12A (QEW)	TTY O/P
11	PASSWORD, HEADING, TOPCOM (QEW)	TTY I/P
13	TOPCOM (QEW)	QEW.OL
14 (WO)	QSPD, QOCC (GMAP)	QPOLY
	DETECTOR, FLASH (GMAP)	FORDPOLY
		WINPOLY
	DISMAP, RDISMAP, SPD1, SPD2 (GMAP)	ERINPOLY
	IOCC, IOC2, RAMPS, BOX1 (GMAP)	MISSPOLY
		HWYPOLY
	BOX2, BOX3	CAWPOLY
15 (RO)	REQEW (GMAP)	QEWDYN

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* The task to which the routine belongs or the task itself.

Table 7/ Control Software Parameters

Variables	Meaning
ALMBEEP	= 1 Sound beep at console.
ALMFLG	Flag word to record sign malfunction to disk file in the 30 s routine ALM30S.
AMODE	Sign stand-alone flag. = 1 in sign stand-alone mode.
APARM (6)	APARM(1): Speed threshold value APARM(2): 30 s OCC threshold value APARM(3): 5 m lower-bound OCC threshold value APARM(4): 5 m upper-bound OCC threshold value APARM(5): 5 m (15 m for exit detector) lower-bound volume threshold value APARM(6): 5 m upper-bound volume threshold value
BUFSIZ	Buffer size for sign message.
CAP (22)	Station Capacities.
CHEK1 (10)	If command transmitted ≠ command received, then CHEK1 stores command as received by NOVA from HP.
CHEK2 (10)	If command transmitted ≠ command received, then CHEK2 stores command as transmitted to HP by NOVA.
CNTADR (10)	Controller addresses.
CNTON (10)	Controller status flag for each ramp, on =1, off = 0.
COMDOP (8)	Control command buffer transmitted to HP.
CONMSG (2)	Control words to BDCSP.
CONTRL	Control Period, from 0 to 3 = 0 No ramps are metered = 1,3 Ramps may or may not be metered = 2 All ramps are metered at least at minimum cycle lengths.
COUNT	30 s counter.
CSTAT (10)	Controller status; 0 for O.K.; 1 not O.K.

Table 7/ (Continued)

Variables	Meaning
CTRMOD	Control period manual override by operator. 0 to 3 = control period numbers 4 = automatic advancement in control period
CYCOVR (10)	Has values ranging from 0 to 9 except 7 for each ramp. Cycle length override by operator. '1' to '5' are cycle length numbers, '0' metered green, '8' by default automatic control mode, '9' controller dropped offline, and '6' controller will select one of the valid cycle lengths based on local occupancy.
DATA30 (718)	30 s data buffer.
DETECT (545)	1 s data buffer from HP to NOVA.
DFREQ	Error limit for CR710 traffic controllers.
DIST (20)	Distances between detector stations on the QEW section.
DNRNGE (67,3)	This contains error counts for downstream loop detectors. First 2 elements in each row contain the same information as explained in UPRNGE, except for the downstream detectors. Element 3 in each row contains error counts for double elapsed time/vehicle < 1 min.
DOCC1S (67)	Accumulated 1 s occupancy counts for downstream mainline detectors.
DTIME (67)	Accumulated downstream occupancy counts for mainline detectors till volume is > 1. Then it is reset to 0.
DTOT	No. of double loop detectors.
DVOL1S (67)	Accumulated 1 s volume counts for downstream mainline detectors.
ERHARD	Out-of-range error counts.

Table 7/ (Continued)

Variables	Meaning
ERRB5 (5)	Number of consecutive times that bit 5 of each C170 controller is on.
ERRCNT (10)	The number of consecutive error counts for different transmitted and returned commands for traffic controllers on each ramp.
EXVOL (11)	Used to accumulate 15 min exit-detector volumes.
IDATA	Number of times DATAIN routine is executed. If = 30, then NXFER subroutine is executed and TRANSF task activated. Then it is re-initialized to 0.
IFLG	Conditional flag used for overlays.
IMIN	Minimum acceptable occupancy/vehicle in pulses.
IMIN5	5 min flag.
INCDNT	When set, used to alarm the operator.
INCEX	Used to signal the execution of the incident detection program 'INCDET', 1 min after data collection has started.
INCFLAG (21)	= 0, no incident; = 1 when incident detected, appplies to all stations except the most downstream one.
INCNT (21)	Incident time counter to keep track whether the incident lasts at least 1 min.
INCREC (21)	If positive, used to indicate the record number of the incident file "INCLOG" in which the station incident information was written when the incident happened, one word for each station except those stations with no downstream stations. For example, if word 5 contains 6, it means that station 5 had an incident, the information of which was written in record number 6 of "INCLOG", so that when the station incident is cleared, some more information can be written in the same record. Again station 1 has two words, one for downstream station 2, and one for downstream station 3.

Table 7/ (Continued)

Variables	Meaning
INCSTAT (21)	= 0, no 'true' incident; = 1 after incident confirmed by 1 min persistence check (true incident).
INCTV (84)	Incident threshold values, 4 for each station, excluding the most downstream station. Station 1 has 2 sets of threshold values, one for downstream station number 2, one for downstream station number 3.
K5M	5 min data record number.
KCNT5M	5 min counter, reset every 15 min.
KCNTD	Number of consecutive times the transmitted and the received messages do not match up. Two consecutive times means sig[illegible]function.
KCOUNT	30 s counter for graphic program.
KDISP	Graphic file 'QEWDYN' record number.
KINC	Incident record number.
KL30S	Disk file number for DATA30.
KQCNT (10)	Time count during queue override control to reduce one cycle length number.
KSTEP (10)	Time threshold in terms of 30 s steps (e.g., 6 = 3 min) to reduce one cycle length number during queue override control.
KTHR	Time threshold in terms of 30 s steps for the ramps to have green signals during queue override control.
KTIME	Counter to activate protocol number 3.
KTLMT (10)	Time count during queue override control to meter that ramp with a green signal.
LATST	If = 1, then DATAIN will not compute speed.
LDIST (67)	Distance between the upstream and downstream loop pair.

Table 7/ (Continued)

Variables	Meaning
LIGHTS (10)	To keep track of red, yellow and green bits on 30 s basis.
LTCOND (10)	To keep track of which lights (red, yellow or green) were on, updated every second for 30 s.
LTSTAT (10)	Light status, 1 not O.K.
LVC1S (67)	Long vehicle lane counts per second.
MAXOCC	Maximum number of pulses (occupancy) per second.
MAXCYC	Maximum number of cycle lengths chosen in a controller.
MAXSPD	Maximum speed allowed.
MAXVEH	Maximum acceptable volume counts per second.
MCNT (10)	Index to map ramp numbers to corresponding positions in command (transmit or return) buffer.
MDMDET (73)	The lowest order digit of i^{th} word contains number of detectors associated with the i^{th} address, and the high order digits point to the starting location in XTB (180) which again points to a location in XREFTB vector, where the first detect ID is stored.
MDY	Month, Day and Year.
MSGID	Message sequence number for protocol number 1.
METER (10)	= 0, no ramp metering, = 1, ramp metering for that ramp.
MODCYC (10)	Indicates which control mode each ramp is in, whether it be under local occupancy, upstream occupancy or upstream volume control, or a combination of the three above, or queue override control, or manual override, or no control.
MODEM (148)	Modem status (0 = good, > 0 no good)
MODEM1 (73)	Accumulated modem response error counts, done every second.

Table 7/ (Continued)

Variables	Meaning
MODEMT (299)	MODEMT (4 - 151) modem response from HP; MODEMT (151 - 299) total accumulated modem response error counts.
MODNO (73)	Contain modem numbers for corresponding modem addresses.
MTLSGN (2)	Contains destination addresses for sign message.
NALREC	'ALMREC' record number.
NBRAMP	NBRAMP = 1 => transmitting commands to C170 N/B ramps; NBRAMP = 0 => transmitting commands to C170 S/B ramps, and comparing transmitted commands to return messages for the C170 controllers, each of which controls 2 ramps. NBRAMP takes on the value of 0 and 1 every other second.
NDD	Number of demand detectors.
NED	Number of exit detectors.
NEPROR (73)	Response error recovery counter for all modem addresses.
NMSGRX	Number of messages received via protocol number 5.
NMSGTX	Number of messages transmitted via protocol number 4.
NOBEEP	= 1 Silence beep permanently; = 0 initially.
NPD	Number of passage detectors.
NQD	Number of queue detectors.
NRAMPS	Number of ramps.
NSTNS	Number of stations.
NUMMDM	Total number of modem addresses in the system.
NWORDS	Number of words in the transmitted message including the address and control characters.
NWREC	Number of weather records.

Table 7/ (Continued)

Variables	Meaning
OCCDBI (21)	Downstream station occupancy at the instant of incident occurence.
OCC1S (46)	Accumulated 1 s occupancy counts for single loop detectors.
P4FLG	Flag word to initiate protocols #4 and #5; = 1, in the process of initiating P#4, > 1 in the process of initiating P#5, = 0, no message being transmitted, or no initiation of either protocol.
PR1ERR	Error counter for protocol #1.
PR2ERR	Error counter for protocol #2.
PR3ERR	Error counter for protocol #3.
PR4ERR	Error counter for protocol #4.
PR5ERR	Error counter for protocol #5.
PROTOCOL	Protocol number.
PSPRT	Time in seconds before protocol #3 is executed.
QIND (10)	= 1 ramp under queue override control; = 0, the opposite.
QLNTH (10)	Queue length for each ramp.
QOCC (13)	Smoothed queue detector occupancies (pulses).
QOCCLB (10)	Lower-bound occupancy threshold values for queue override control (pulses).
QOCCUB (10)	Upper-bound occupancy threshold values for queue override control (pulses).
OCCUBI (21)	Upstream station occupancy at the instant of incident occurence.
QOVR (10)	= 0 by default, queue override allowed for that ramp, = 1 no queue override for that ramp.

Table 7/ (Continued)

Variables	Meaning
QWAIT (10)	Queue waiting time for each ramp.
RAMCYC (10)	Cycle length ID for each ramp ranging from 0 to 6 transmitted to the controller.
RCV170 (5)	Contains return messages from C170 controllers.
RCVBUF (45)	45-word buffer for received message.
REPLY (2)	Response from BDCSP to control words from NOVA.
S1, S2	Smoothing constants for speed computation.
SGNADR (2)	Sign addresses for two different signs.
SGNSTAT (2)	Sign status words for two signs: = 0, O.K.; > 0, not O.K.
STDLN	Standard length of a short vehicle.
STIM1 (46)	Accumulated occupancy counts for single-loop detectors till volume is > 1. Then it is reset to 0.
STOT	Number of single-loop detectors.
THRCP (4)	Time thresholds for automatic advancement in control periods 1, 2, 3, and 0.
THRMQL	Station occupancy threshold for calculating the end of mainline queue.
TIMER	Word in common block KLOCK to wake up COMCOM.
TSKO	Used to wake up Task CORCAS.
TSK1	Used to wake up Task TRANSF.
TSK2	Used to wake up Task GMAP.
TSK3	Used to resume subroutine T14D.
TT (20)	Travel times between stations on QEW.
UOCC1S (67)	Accumulated 1 s occupancy counts for upstream mainline detectors.

Table 7/ (Continued)

Variables	Meaning
UPRNGE (113,2)	In each row, first element contains error counts for volume > MAXVEH, second element contains error counts for occupancy/vehicle < IMIN. First 46 rows are for single loop detectors and the remaining 67 rows are for upstream mainline loop detectors.
UPTIM (67)	Accumulated upstream occupancy counts for mainline detectors till volume > 1, then it is reset to 0.
UVOL1S (67)	Accumulated 1 s volume counts for upstream mainline detectors.
UWAIT (67)	Used to count up to 2 s when certain calculations are performed under certain conditions.
VOL1S (46)	Accumulated 1 s volume counts for single-loop detectors.
VSPEED (67)	Lane speed smoothed every second.
WEATHER (36)	First three words: hour, minute, second; the rest are environmental conditions.
XMT170 (5)	Contains commands transmitted to C170 controllers.
XMTBUF (45)	45-word buffer for transmitted message.
XREF (113)	Indexes to process corresponding detector data in DATA30.
XREFTB (180)	Contains detector numbers.
XTB (180)	Pointers to XREFTB vector to access the required detector IDs for each modem connected to detectors.

Table 7/ (Continued)

DATSTR

Variables	Meaning
DATAX	Array used to pass data between "DATSTR" data gathering routine and "CLDU" routine -- array is used to write to temporary disk file at same name. File is read by "CLDU".
DNOCC	Downstream lane occupancy data index for DATA30 file records.
DNSPO	Downstream lane speed data index for DATA30 file records.
DNVOL	Downstream lane volume data index for DATA30 file records.
DT30S	Array which receives data from logical record of DATA30 file.
INCPRG	Array which signals incident in progress -- this flag is used to discriminate between new incidents and incidents which have already occurred but are not yet cleared. 0 = no incident in progress 1 = incident in progress
INCSTAT	Array which signals incident status -- does not differentiate between new incidents and incidents still in progress. 0 = no incident 1 = incident detected
KL30S	Starting physical record index for logical records of "DATA30" file -- used to read and write to DATA30 -- set [1st physical record of current "DATA30" logical record] + 12 (starting record for next time slice)
REC30	Used to read "DATA30" disk file.
STN	Current collecting station being checked. Counter loop index.
T	Time slice index -- counts number of time slices taken.
TREC	Starting physical record of current "DATAX" logical record.

Table 7/ (Continued)

CLDU

Variables	Meaning
CL	Element of (lane: occ., vol., or spd.) array containing data for the centre lane at the station upstream from the incident.
DATAX	Array accepts data from "DATAX" disk file.
DL	Upstream station driving lane data index.
DNCL	Downstream station centre lane data index.
DNDL	Downstream station driving lane data index.
DNPL	Downstream station passing lane data index.
HMS	hour, minute, second -- common block array containing current system time.
INCPRG	Same as in DATSTR routine.
INCOT	Incident occupancy (occ.) threshold.
INCST	Incident speed (spd.) threshold.
INCVT	Incident volume (vol.) threshold.
INCRMT	Value by which upstream station indices are incremented to calculate downstream station indices.
INCSTAT	Same as in DATSTR routine.
LNOCC	Array containing lane occupancy data for time slice.
LNSPD	Array containing lane speed data for time slice.
LNVOL	Array containing lane volume data for time slice.
MIN	(lane occ., vol., spd.) array index of lane with minimum value.
RDRCD	[physical, logical] record of "RESDEV" disk file to be written to.

Table 7/ (Continued)

CLDU (Continued)

Variables	Meaning
RESDEV	Array containing data to be written to disk file "RESDEV". Used by CLDU routine to pass 'lane of incident' selections to VTLU routine for vote counting.
RSDVR	Array giving record of "RESDEV" contain data for a given station -- similar to 'INCREC' array used earlier with INCLOG.
SIGMA	Value derived through a comparison between the lane with minimum value and the station average. This is tested against the corresponding incident threshold value to determine if the difference is great enough to base a decision on.
STN	Main DO-LOOP index -- indicates current station.
T	Same as in DATSTR.
TREC	Same as in DATSTR.
TOCC	Occupancy index for RESDEV array -- used to store occ. CLDU selection in array to be passed by disk to VTLU.
TSPD	Speed index for RESDEV array.
TVOL	Volume index for RESDEV array.

Table 7/ (Continued)

VTLU

Variables	Meaning
CNTR	Number of votes for centre lane incident.
DRIV	Number of votes for driving lane incident.
HMS	h, min, s -- array containing current system time.
INCLAN	Lane of incident.
INCLOG	Array used to hold "INCLOG" disk file data while lane at incident decision is added.
INCPRG	Same as in DATSTR routine.
INCSTAT	Same as in DATSTR routine.
MDY	Month, day, year -- array containing current system date.
OCCMAJ	Decision of occupancy VTLU.
OCCVOT	Array extracted from "RESDEV" file - contains three votes from occupancy CLDU.
OCWT	Weighting given to lane selection based on occupancy in final vote taking.
PASS	Number of votes for passing lane incident.
RESDV	Local array used to handle "RESDEV" file data. Data read from disk - utilized - written back to disk.
SPDMAJ	'Lane of incident' decision of speed VTLU.
SPDVOT	Array containing votes from speed CLDU.
SPWT	Weighting given to 'SPDMAJ' in final vote taking.
VOLMAJ	'Lane of incident' decision of volume VTLU.
VOLVOT	Array containing votes from volume CLDU.
VLWT	Weighting given to 'VOLMAJ' in final vote taking.

Table 8/ QEW Data File Structure

Output Data File Name	Logical Record Length (Words)	Physical Record Length (Words)
DATA30	718	12 x 64 = 768
DATA5M	430	7 x 64 = 448
QEWDYN	457	8 x 64 = 512
INCLOG	25	1 x 25 = 25
ALMREC	14	1 x 14 = 14
XMTTAB	45	1 x 45 = 45
RESDEV	26	1 x 26 = 26
WEATHER	36	1 x 36 = 36

Table 9/ Ramp Metering Support File Structure

Table File Name	Logical Record Length (Words)	Physical Record Length (Words)
RAMTAB	40	1 x 40 = 40
CYCTAB	25	1 x 25 = 25
QUETAB	256	4 x 64 = 256
CYCLES	50	1 x 50 = 50

MRDOS ——— QEW -- To activate on-line real-time
traffic control system

Figure 1/ First-Level Command Structure

QEW

- RC -- To change ramp control operation
- QO -- To modify queue occupancy override logic
- CMS -- To operate changeable message signs
- G -- To change graphic displays
- INF -- To retrieve traffic flow information
- H -- To monitor and control hardware operation
- JCW -- To monitor and control system operation
- X -- Reserved for new commands

Figure 2/ Second-Level Command Structure Under QEW

RC

- C $N_1N_2..N_iM\#$ - To override ramp controller metering rate
- P N - To change advancement of ramp control period
- T $N_1N_2N_3N_4$ - To change ramp control period start time frame
- RM$N_0N_1N_2..N_i$ - To update co-ordinated ramp control tables "RAMTAB", "CYCTAB", "CYCLES"
- E - To exit command

Figure 3/ Third-Level Command Structure Under "RC"

QO	- N#	- To enable queue override logic on ramp No. #
	- D#	- To disable queue override logic on ramp No. #
	- L $N_1 N_2 \ldots N_{10}$	- To change lower-bound Q-OCC threshold values on all 10 ramps in terms of number of pulses
	- U $N_1 N_2 \ldots N_{10}$	- To change upper-bound Q-OCC threshold values on all 10 ramps in terms of number of pulses
	- T M S $N_1 N_2 \ldots N_{10}$	- To set queue override time limit, M, before steady green and number of 30-s time step, N_i, i = 1, 2, .., 10 during cycle length reduction process
	- P	- To print out common buffer related to ramp metering strategy and queue override
	- E	- To exit command

Figure 4/ Third-Level Command Structure Under "QO"

CMS	- A	- To add a message to the message file
	- B	- To print message transmit and receive buffers
	- D#	- To delete message number # from the message file
	- L	- To list all transmitted CMS messages
	- S N M #	- To send message number # from message file to sign controller N
	- P#	- To print message number # from message file
	- E	- To exit command

Figure 5/ Third-Level Command Structure Under "CMS"

G

- Q -- Main QEW display
- F -- Ford Drive Interchange (IC) display
- W -- Winston Churchill Blvd. IC display.
- S -- Southdown Road IC display
- M -- Mississauga Road IC display
- H -- Highway 10 IC display
- C -- Cawthra Road IC display
- N -- To freeze display for hard copies
- E -- To exit command
- O -- To use occupancy for colour display
- V -- To use speed for colour display

Figure 6/ Third-Level Command Structure Under "G"

INF

- I $M_1M_2N_1N_2N_3N_4$ - To modify incident detection threshold and to retrieve incident information
- D N_1N_2 - To retrieve 5-min detector data
- S N_1N_2 - To retrieve 30-s mainline speed data
- V N_1N_2 - To retrieve 5-min truck and passenger car volume count
- E - To exit command

Figure 7/ Third-Level Command Structure Under "INF"

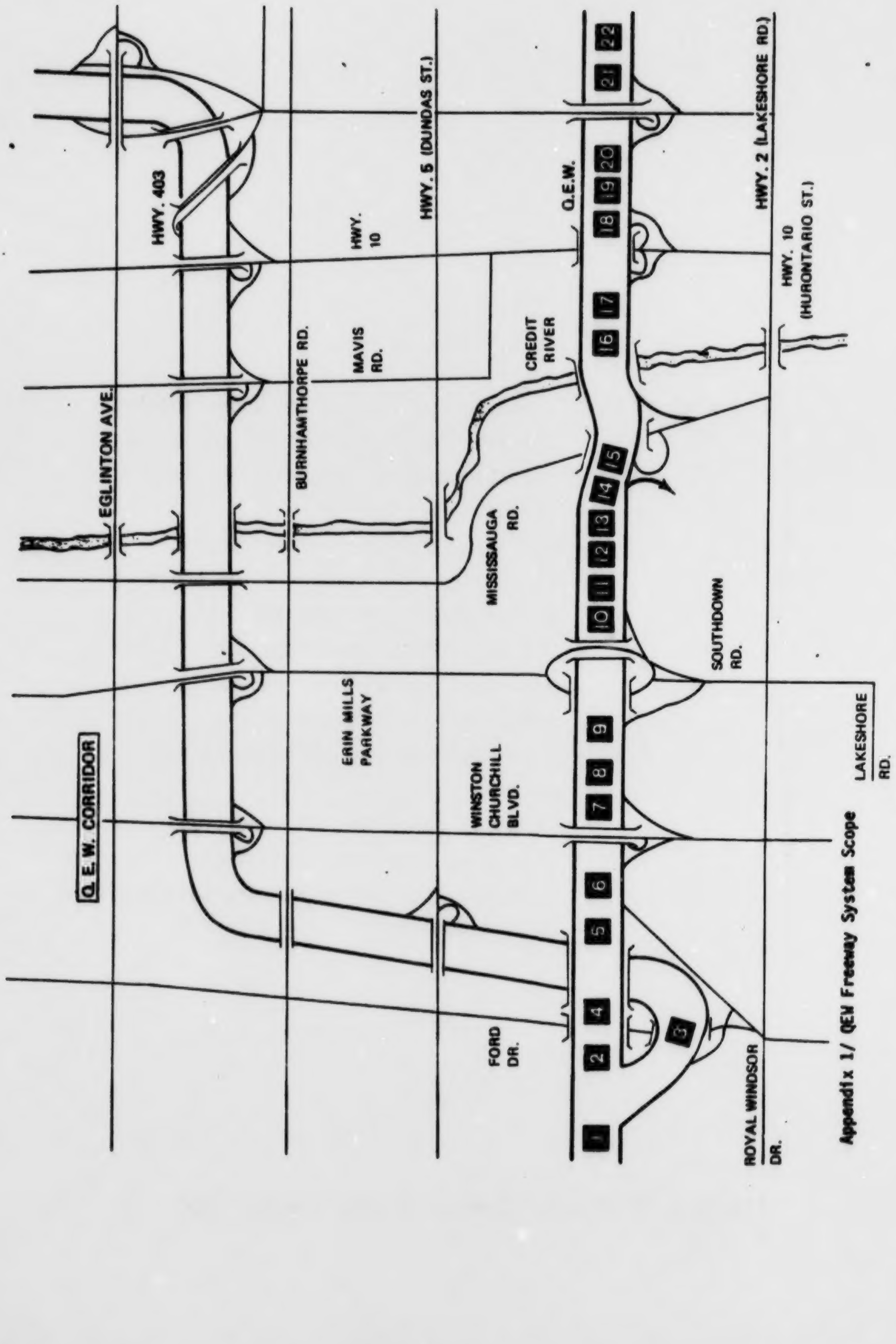
H

- BA - To enable all "BEEP" sound
- BN - To silence individual "BEEP" sound
- BD - To disable all "BEEP" sound
- C N_1 N_2 - To enable ramp controllers
- D N_1 N_2 - To enable loop detectors
- K N_1 N_2 - To disable loop detector
- L N_1 N_2 - To enable ramp metering signal lights
- M N_1 N_2 - To enable data modems
- SE - To enable changeable message signs
- SD - To disable changeable message signs
- PN - To print hardware error report
- E - To exit command

Figure 8/ Third-Level Command Structure Under "H"

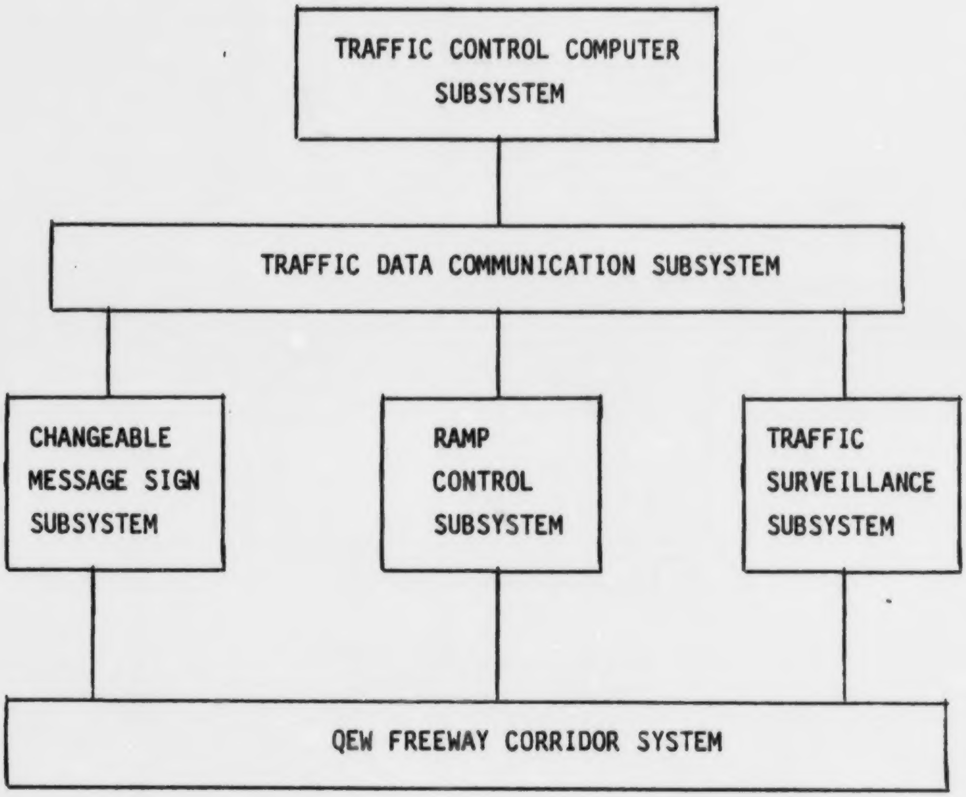
JCW	A N_1 N_2 N_3	To modify ramp controller modem address
	DI	To disable console interrupt mechanism
	EN	To enable console interrupt mechanism
	F	To finish FSCS operation
	D	To display detector buffer content transmitted from communication processor
	T	To display current time and date
	M	To display data modem echo test results
	PN	To control and display computer-to-computer communication information
	S N_1 N_2 N_3	To modify sign controller identification number
	W	To modify environmental conditions
	Y	To display loop detector out-of-range errors
	Z	To display controller command output buffer
	E	To exit command

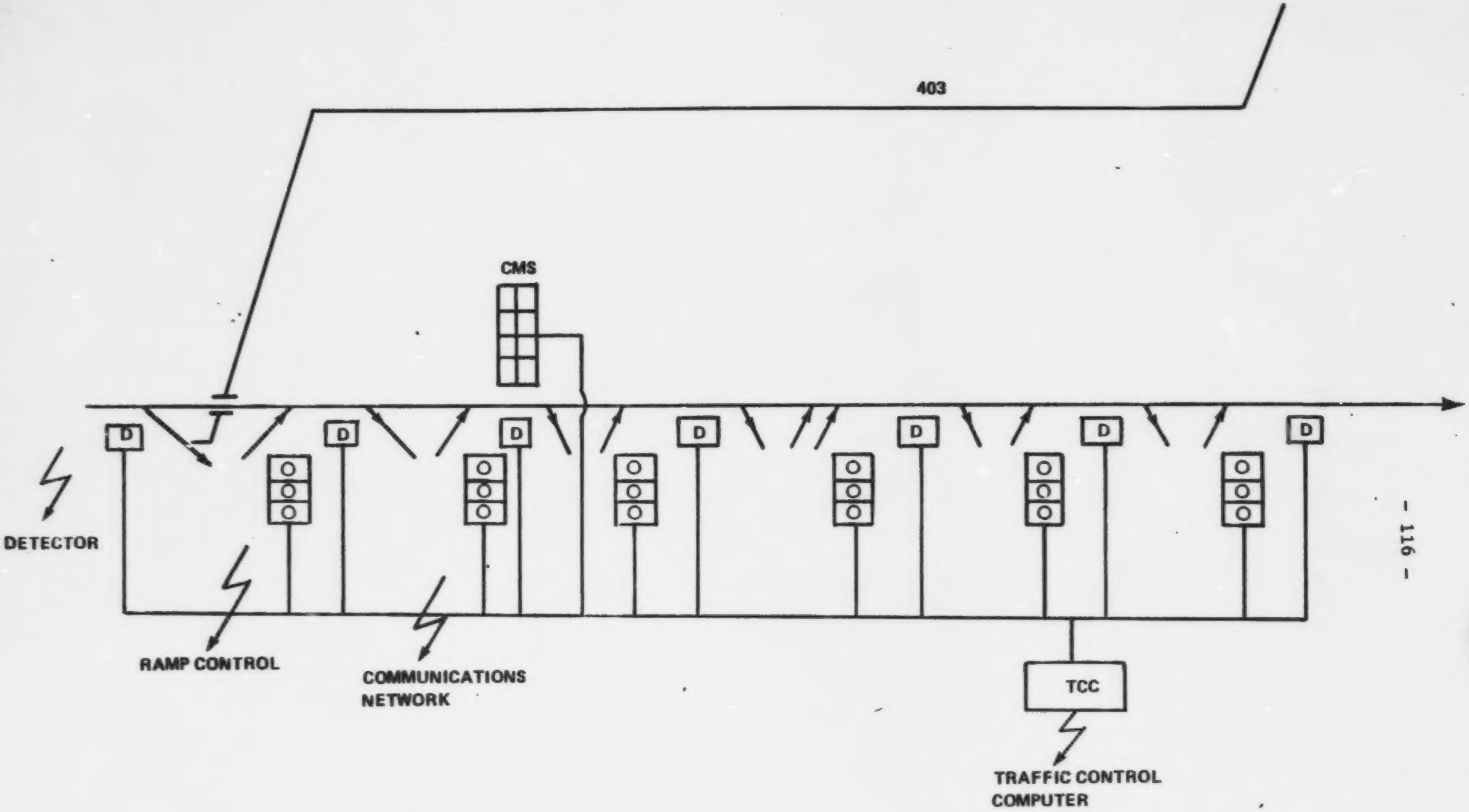
Figure 9/ Third-Level Command Structure under "JCW"



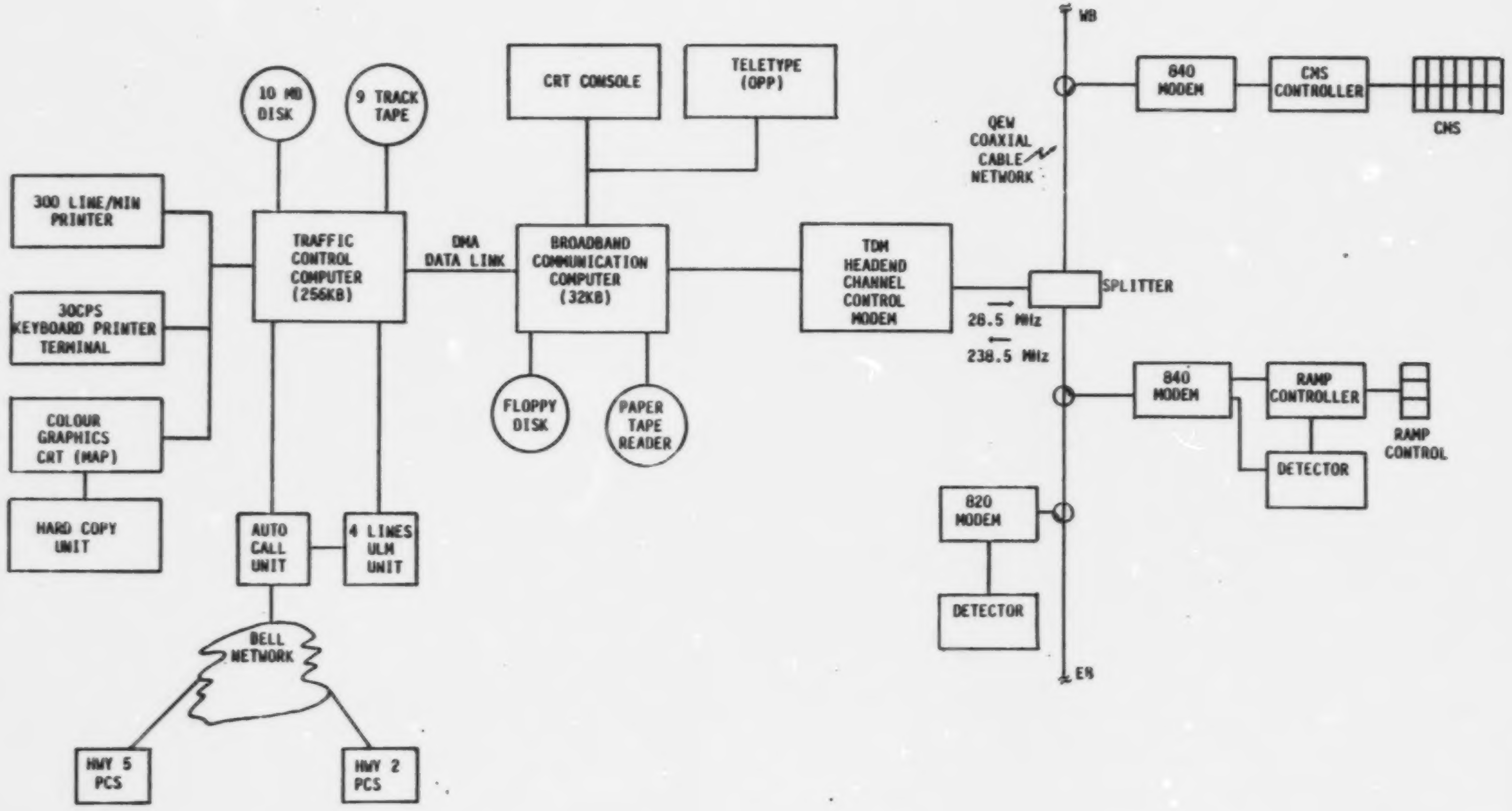
Appendix 1/ QEW Freeway System Scope

Appendix 2/ The QEW Hardware System Scope


TRAFFIC CONTROL COMPUTER SUBSYSTEM
TRAFFIC DATA COMMUNICATION SUBSYSTEM
CHANGEABLE MESSAGE SIGN SUBSYSTEM
RAMP CONTROL SUBSYSTEM
TRAFFIC SURVEILLANCE SUBSYSTEM
QEW FREEWAY CORRIDOR SYSTEM



Appendix 3/ Conceptual QEW Control System Configuration



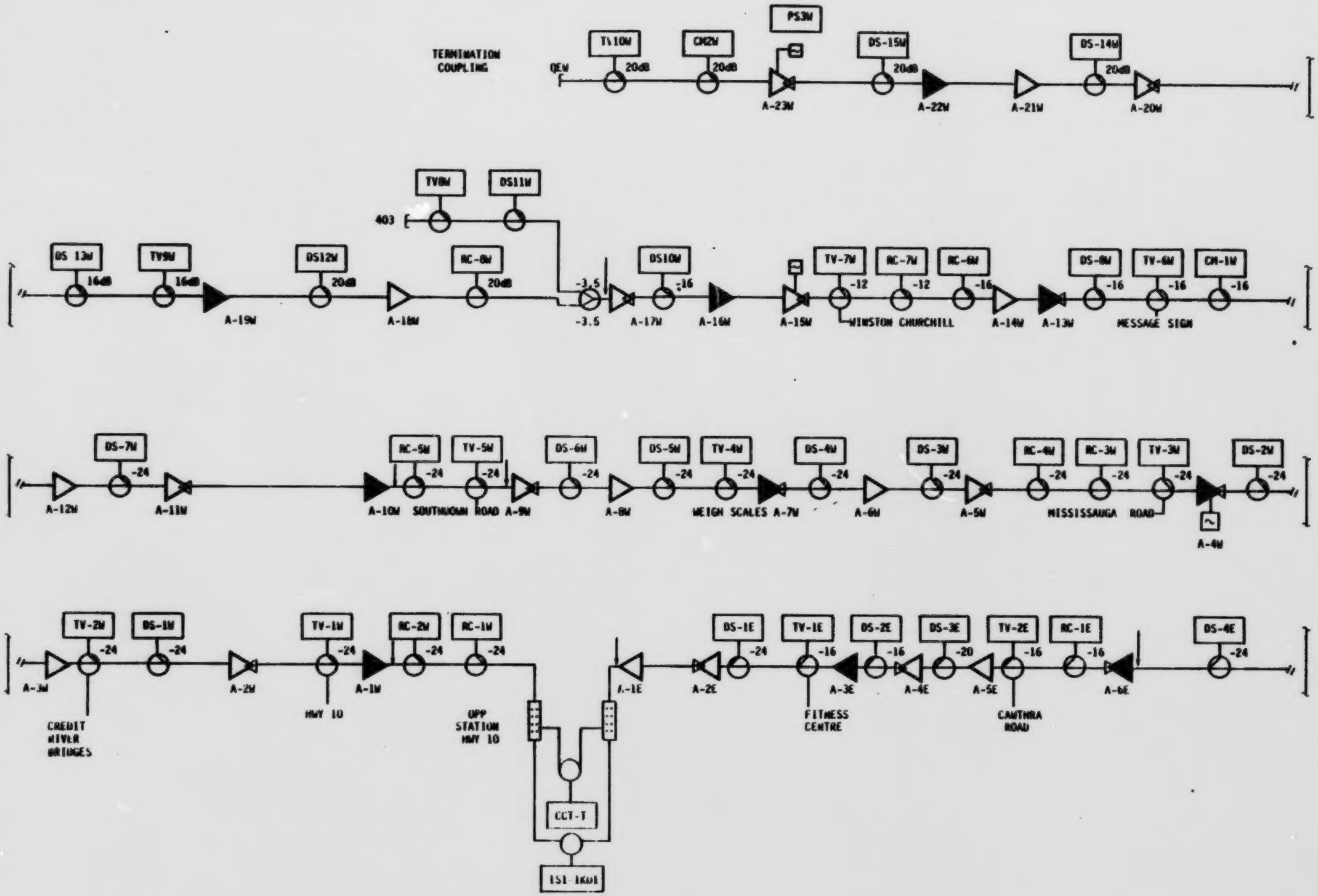
Appendix 4/ The Control Computer Hardware System Block Diagram

Appendix 5/ NOVA 4/X Control Computer CPU Chassis Configuration

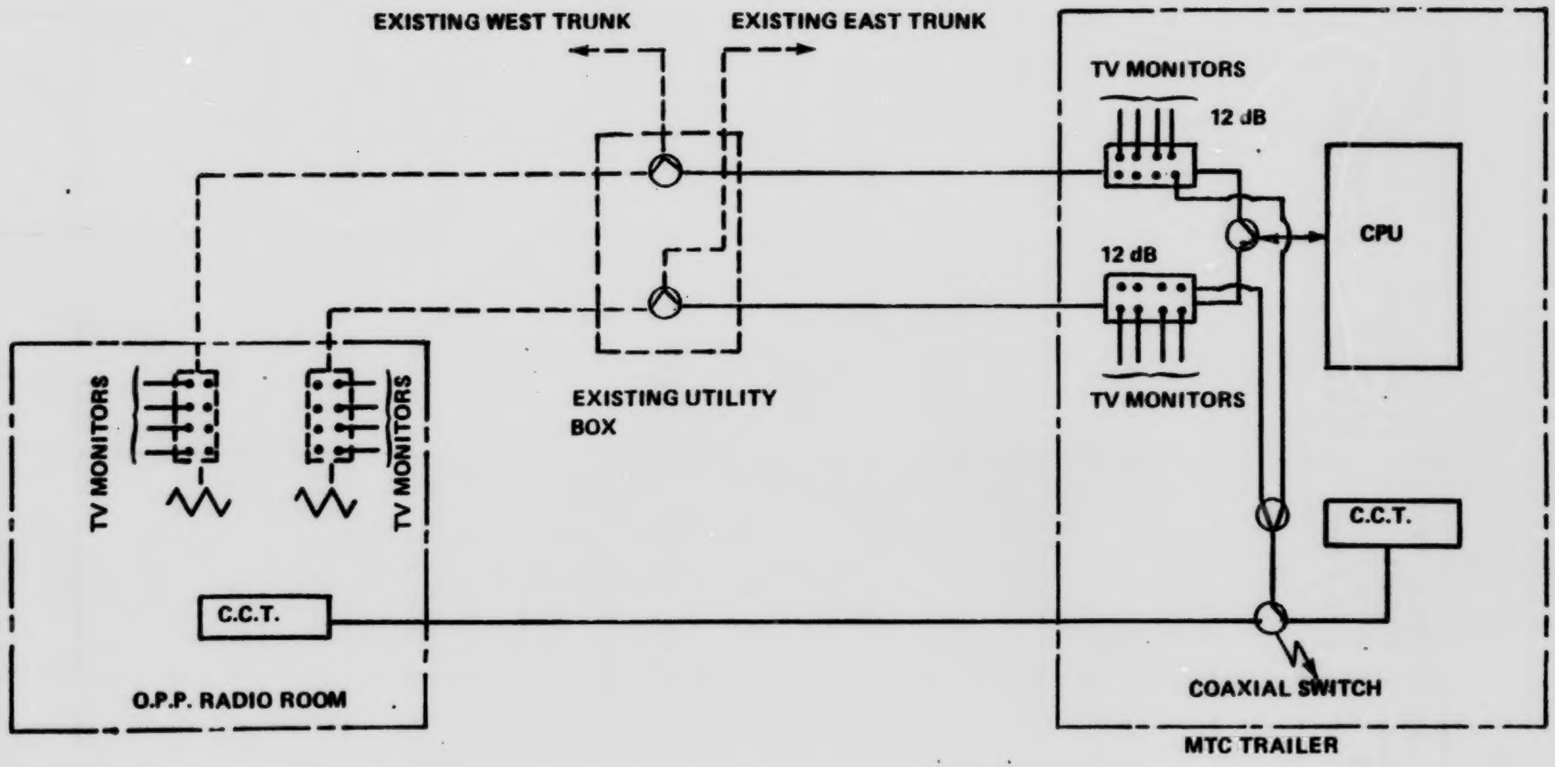
Slot #	15" square PCB Function
16	ISI HP 21MX DMA Interface
15	4075 I/O Interface for Tek 4027
14	4241 Asynchronous Multiplexor
13	6027 Tape Controller
12	6045 Disk Controller
11	Line printer
10	4014 I/O Interface
9	I/O
8	I/O
7	I/O
6	I/O
5	I/O Reserved
4	I/O Reserved
3	256 kB MOS Memory
2	FPU
1	CPU, RTC, MMPU
0	Power Supply

Appendix 6/ HP 21MX Communication Computer CPU I/O Slot Assignment

Slot #	Device
6	Computer-computer channel DMA control
10	Head-end receive channel
11	Teletype
12	Computer-computer channel data port
13	Paper tape reader
14	Time base generator
15	Head-end transmit channel



Appendix 7/ QEW Broadband Coaxial Cable Network Layout



Appendix 8/ New QEW Control Center and OPP Radio Room Coaxial Cable Layout

Appendix 9/ Coaxial Cable Network Tap Station Carrier Level

Tap Station Carrier Levels

Tap Stations (CPU Address)	Signal Level with Attenuation @ 28.8 MHz	Signal Level without Attenuation @ 28.8 MHz	Signal Level with Attenuation @ 238 MHz	Signal Level without Attenuation @ 238 MHz
RC-1W (10-13)	+20	30	20	33
RC-2W (14-17)	+18	28	15	25
TV-1W				
DS-1W (20)	20	33	19	47
TV-2W				
DS-2W (21)	18	48	17	56
TV-3W				55
RC-3W (24-27)	20	32	20	44
RC-4W (30-33)	22	28	17	29
DS-3W (34)	22	32	16	35
DS-4W (35)	18	24	17	38
TV-4W				
DS-5W (36)	23	29	15	27
DS-6W (37)	22	22	18	33
TV-5W				
RC-5W (40-43)	21	21	20	20

Appendix 10/ Broadband Amplifier Input and Output Level

System Levels as set November 10, 1980

Amplifier
Type

Amplifier STN	A-1W	A-2W	A-3W	A-4W	A-5W	A-6W	A-7W	A-8W	A-9W	A-10W	A-11W	A-12W
CH-3V 61.25MHz	+20 +30	+20 +30	+16 +30	+16 +25	+12 +26	+12 +24	+20 +24	+8 +28	+8 +28	- -	- -	- -
CH-4V 67.25MHz	+20 +30	+20 +30	+16 +30	+16 +25	+14 +28	+14 +24	+20 +24	+8 +28	+8 +28	+15 +22	+15 +22	+13 +25
CH-6V 83.25MHz	+26 +38	+26 +40	+20 +40	+25 +30	- -	- -	- -	- -	- -	- -	- -	- -
CH-7V 175.25MHz	+6 +24	+6 +28	+6 +28	+10 +25	+6 +24	+6 +24	+8 +28	- -	- -	- -	- -	- -
CH-10V 193.25MHz	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
CH-12V 205.25MHz	+12 +30	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
CH-13V 211.25MHz	+10 +30	+10 +30	+10 +32	+12 +30	+10 +30	+8 +28	+10 +30	+6 +30	+6 +30	+13 +26	+13 +26	+7 +28
Test C.W. 249MHz	+10 +30	+12 +33	+10 +33	+12 +25	+10 +33	+10 +32	+12 +32	+8 +32	- -	-	-	-
FSK 23.5 MHz	+33 +33	+21 +50	+39 +39	+30 +39	+28 +34	+39 +39	+30 +45	+39 +39	+28 +39	+33 +33	+28 +35	+29 +29
ISI 28.8 MHz	+54 +54	+45 +62	+51 +51	+45 +62	+56 +68	+56 +56	+50 +65	+59 +59	+48 +50	+48 +48	+42 +50	+44 +44

Appendix 10/ Cont'd

SYSTEM CARRIER LEVELS dBmV

I/P - O/P

Coil freq.	Band		A-18W	A-19W	A-20W	A-21W	A-22W	A-23W
30 MHz	Sub Band		- -	- -	+21 +35	- -	- -	+20 +35
88 MHz	Low Band		+10 +21	+10 +18	+10 +20	+10 +19	+10 +17	+10 +19
174 MHz	Mid Band		+10 +24	+10 +20	+10 +23	+10 23	+10 +20	+10 +23
216 MHz	High Band		+10 +27	+10 +22	+10 +24	+10 +25	+10 +22	+10 +25
300 MHz	Super Band	- -	+10 +30	+10 +24	+10 +27	+10 +28	+10 +24	+10 +28

Appendix 11/ The Connection Between Data Modem and The Coaxial Cable Tap Station

Tap Station Identification	Modem Address	Traffic Station Identification
W/B		
RC1W	10 - 13	C1
RC2W	14 - 17	C2, S18
DS1W	20	S17
DS2W	21	S16
RC3W	24 - 27	C3
RC4W	30 - 33	C4, S15
DS3W	34	S14
DS4W	35	S13
DS5W	36	S12
DS6W	37	S11
RC5W	40 - 43	C5, S10
DS7W	45	S9
CM1W	44	CMS1
DS8W	46	S8
RC6W	50 - 53	C6, S7
RC7W	-	-
DS10W	54	S6
DS11W	-	-
RC8W	60 -63	C7, S5
DS12W	64, 65, 66	S4, S3
DS13W	70	S2
DS14W	71	S1
DS15W	-	-
CM2W	-	-
E/B		
DS1E	100	S19
DS2E	101	S20
DS3E	102	off-ramp
RC1E	104 - 107	C8, S21
DS4E	110	S22

Appendix 12/ Modem Address Assignment

The table below shows the assignment of modem addresses to traffic devices. Addresses with no devices attached are followed by ---. Detector inputs are labeled as single detectors (SD) or double detectors (DD). Note that single detectors and double detectors cannot be mixed on a single modem address.

The modem # is followed by (1) or (4) to indicate whether the modem is a 1-address or 4-address modem. New modems in the system expansion are marked with *. As indicated below, one address must be unused between West and East detectors, to allow for signal propagation delays.

The reset address is critical for system timing. Reset after 148 addresses (reset address set to 144) gives almost exactly 25 scans per second [((48 000 bits per second/13 bits per word)/148 words per scan) = (24.95 scans per second)]

Modem # (#adrs)	Octal Modem Address	Traffic Device #	# Inputs	# Outputs	Approx ft W or E of Head-end
	0-7	---(reserved for system timing)			
1 (4)	10	C1	8	8	164 W
	11	C1	8 (status)		
	12	D1,D2,D5,D7	4 SD		
	13	---			
2 (4)	14	C2	8	8	302 W
	15	C2	8 (stat)		
	16	D3,D4,D6,D8,D9	5 SD		
	17	D10,D11,D12,D13,D14,D15	6 DD		
3 (1)	20	D16,D17,D18,D19,D20,D21	6 DD		2741 W
4 (1)	21	D22,D23,D24,D25,D26,D27	6 DD		5199 W
	22	---			
	23	---			

Modem # (#adrs)	Octal Modem Address	Traffic Device #	# Inputs	# Outputs	Approx ft W or E of Head-end
5 (4)	24	C3	8	8	7309 W
	25	C3	8 (stat)		
	26	D28,D29,D30,D36,D37	5 SD		
	27	---			
6 (4)	30	C4	8	8	8233 W
	31	C4	8 (stat)		
	32	D31,D32,D33,D34,D35	5 SD		
	33	D38,D39,D40,D41,D42,D43	6 DD		
7 (1)	34	D44,D45,D46,D47,D48,D49	6 DD		10618 W
8 (1)	35	D50,D51,D52,D53,D54,D55	6 DD		13020 W
9 (1)	36	D56,D57,D58,D59,D60,D61	6 DD		16039 W
10 (1)	37	D62,D63,D64,D65,D66,D67	6 DD		18277 W
11 (4)	40	C5	8	8	20667 W
	41	C5	8 (stat)		
	42	D68,D69,D70,D77	4 SD		
	43	D71,D72,D73,D74,D75,D76	6 DD		
*12 (1)	44	D78,D79,D80,D81,D82 D83,D840,D84	8 DD		23100 W
13 (1)	45	sign controller	RS232C	RS232C	24308 W
*14 (1)	46	D85,D86,D87,D88,D89,D90	6 DD		25846 W
	47	---			
*15 (4)	50	C6	8	8	29142 W
	51	C6	8 (stat)		
	52	D91,D92,D93,D94,D95, D96,D97,D98	8 SD		
	53	D99,D100,D101,D103 D103,D104	6 DD		
*16 (1)	54	D105,D106,D107,D108 D109,D110,D111,D112	8 DD		32390 W
	55	---			
	56	---			
	57	---			
*17 (4)	60	C7	8	8	34520 W
	61	C7	8 (stat)		
	62	D113,D114,D115,D116	4 SD		
	63	D117,D118,D119,D120 D121,D122	6 DD		

Modem # (#adrs)	Octal Modem Address	Traffic Device #	# Inputs	# Outputs	Approx ft W or E of Head-end
*18 (4)	64	D123,D124,D125,D126, D127,D128	6 DD		37717 W
	65	D129,D130,D131,D132, D133,D134	6 DD		
	66	D135,D136	2 SD		
	67	---			
*19 (1)	70	D137,D138,D139,D140, D141,D142	6 DD		40201 W
*20 (1)	71	D143,D144,D145,D146, D147,D148	6 DD		42760 W
	72	---			
	73	---			
	74	---			
	75	---			
	76	---			
	77	--- (reserved for system timing btw W & E)			
*21 (1)	100	D501,D502,D503,D504, D505,D506	6 DD		2285 E
*22 (1)	101	D507,D508,D509,D510, D511, D512	6 DD		5058 E
*23 (1)	102	D519,D520	2 SD		6390 E
	103	---			
*24 (4)	104	C8	8	8	7744 E
	105	C8	8 (stat)		
	106	D513,D514,D515,D516, D517,D518	6 SD		
	107	D521,D522,D523,D524, D525,D526	6 DD		
*25 (1)	110	D527,D528,D529,D530, D531,D532	6 DD		10651 E
reset addr.	220	(for reset on 224 octal [148 decimal])			

Appendix 13/ Cable Delay Modification

Prepared by Larry Deck and Checked by Tom Bennett

This document is on floppy "MTC" (1006) [30,24]CABLEDELA.DOC

Introduction

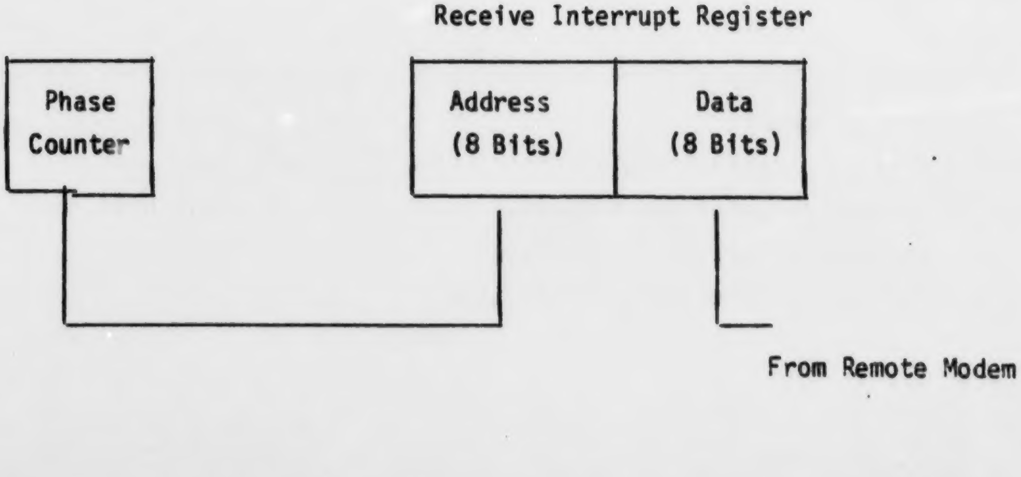
The cable delay modification is a design change, standard on new head-ends, which allows the head-end to control longer cables.

Cable delay is the time it takes for a signal, traveling at approximately the speed of light, to go from the head-end to a remote modem and back. Maximum cable lengths in miles, with and without the modification, are approximately as follows:

Baud Rate ---	48 000	24 000	12 000	(Etc.)
Cable length without mod	6	12	24	
Cable length with mod	20	40	80	

The modification is standard on new head-ends with transmit card Model number 23038 (BM78-8029-5077-8) and receive card Model number 23150 (BM78-8029-5081-2).

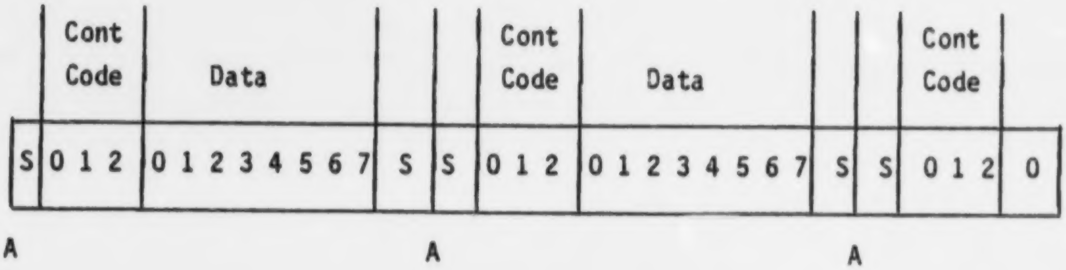
Relevant Headend Components



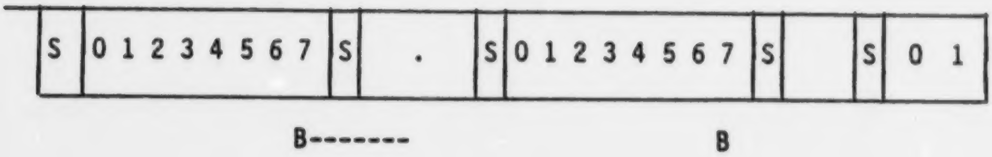
The head-end's phase counter is appended to the input data from a remote modem to tell the computer which modem address the data came from. The cable delay modification changes the time at which the phase counter is loaded into the receive interrupt register.

Timing Without Modification

Transmit
Data
(13 Bits
Per Word)


Cont Code
Data
Cont Code
Data
Cont Code
S 0 1 2 0 1 2 3 4 5 6 7 S S 0 1 2 0 1 2 3 4 5 6 7 S S 0 1 2 0
A
A
A

Receive
Data
(10 Bits
Per Word)



Point A: Head-end phase counter is incremented (beginning of start bit of TX word).

Point B: Receive interrupt register is loaded with input data and current value of phase counter (middle of last input bit), and received interrupt is generated.

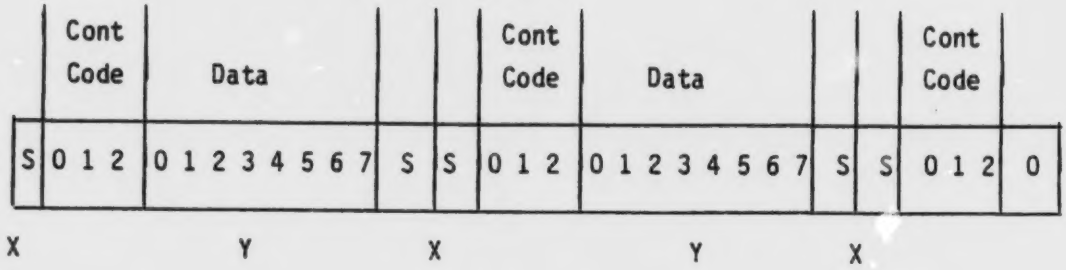
B-- > A: Maximum cable delay -- 3 bit times.

If there is no cable delay, the input data is offset by 1/2 bit time from the transmit data, as indicated. As a cable becomes longer, the input data from a modem will return later with respect to the head-end's transmit data. That is, the receive data will slide to the right, and point "B" will slide closer to Point "A". If "B" slides past "A", the phase counter will have been incremented, and the input byte will have the wrong address appended. Thus the cable delay must be less than 3 bit times. Example:

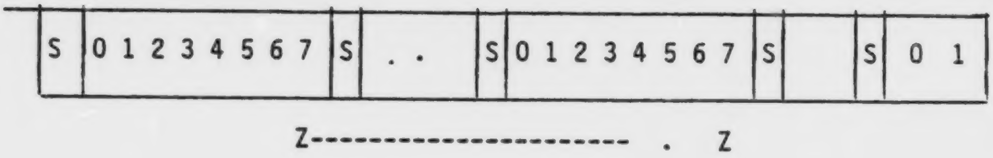
Signal speed on cable = 1000 ft/μs
Bit time at 48 000 baud = 20 μs/bit
Maximum cable length
  = (3 bits) * (20 μs/bit) * (1000 ft/μs)
  = 60 000 ft (in and out)
1/2 * 60 000 = 30 000 ft = 6 miles (one way)

Timing With Modification

Transmit
Data
(13 Bits
Per Word)


Cont Code
Data
Cont Code
Data
Cont Code
S 0 1 2 0 1 2 3 4 5 6 7 S S 0 1 2 0 1 2 3 4 5 6 7 S S 0 1 2 0
X
Y
X
Y
X

Receive
Data
(10 Bits
Per Word)


S 0 1 2 3 4 5 6 7 S . . S 0 1 2 3 4 5 6 7 S S 0 1
Z--------------------- . Z

Point X: Head-end phase counter is incremented (beginning of start bit TX word).

Point Y: Phase counter is loaded into receive interrupt register (end of fourth bit of transmit data).

Point Z: Input data is loaded into receive interrupt register (middle of last input bit), and receive interrupt is generated.

Z--- > Y: Maximum cable delay --- 11 bit times.

Input point "Z" may slide 11 bit times to point "Y" before the receive interrupt register is loaded with the next address. Example (48 000 baud):

Maximum cable length
= 1/2 * (11 bits) * (20 μs/bit) * (1000 ft/μs)
= 110 000 ft
= 20 miles (one way)

Software Implications -- Interrupt Servicing Time

Without the cable delay modification, the software has the full 13 bit times to service a receive interrupt (that is, until the next input byte is received). Example (48 000 baud):

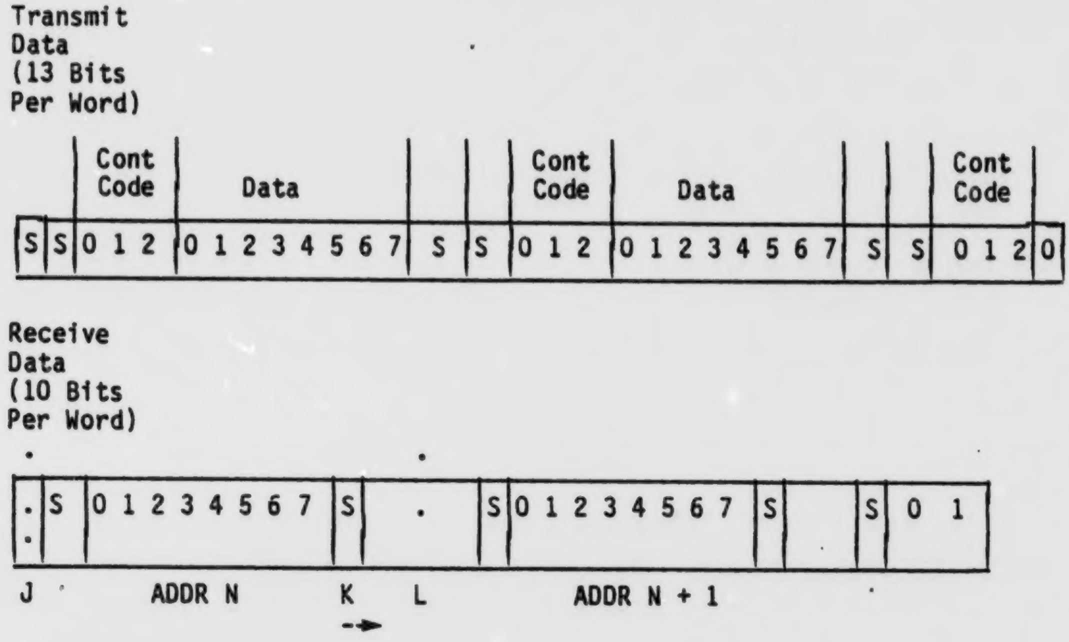
13 bits/48 000 bits per s = 270 μs

With the modification, the software must service a receive interrupt before the phase counter is pre-loaded into the receive interrupt register -- that is, within the time between "Z" and "Y". If there is no cable delay, this interval is 11 bit times. As cable length increases, response time Z→ Y becomes shorter. Example (48 000 baud):

11 bits/48 000 bits per s = 229 μs maximum

Distance Between Consecutive Address

If an address is substantially closer to the head-end than the address before it, their RF carrier signals may be on at the same time, causing problems.


Transmit Data (13 Bits Per Word)
Cont Code
Data
Cont Code
Data
Cont Code
S S 0 1 2 0 1 2 3 4 5 6 7 S S 0 1 2 0 1 2 3 4 5 6 7 S S 0 1 2 0
Receive Data (10 Bits Per Word)
S 0 1 2 3 4 5 6 7 S S 0 1 2 3 4 5 6 7 S S 0 1
J
ADDR N
K
L
ADDR N + 1

Point J: Remote modem address "N" turns on its carrier.

Point K: Remote address "N" turns off its carrier (end of stop bit).

Point L: Remote address "N + 1" turns on its carrier.

K--► L: Maximum delay between addresses "N" and "N + 1"; that is, address "N" must not be more than 1 bit time farther from the head-end than address "N + 1".

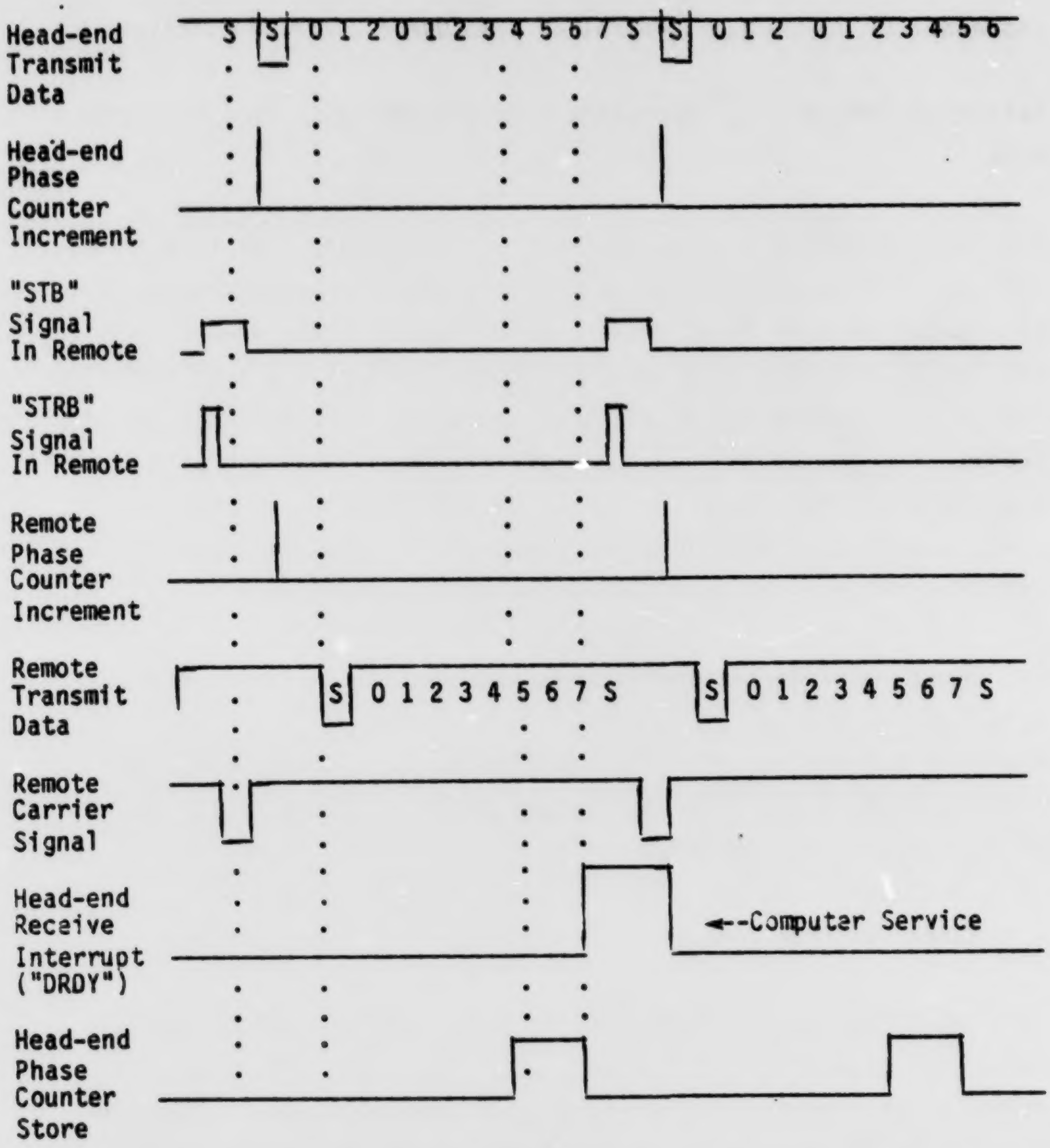
Example (48 000 Baud):

Maximum distance ADDR N may be beyond ADDR N + 1
= 1/2 * (1 bit) * (20 μs/bit) * (1000 ft/μs)
= 10 000 ft
= 2 miles (one way)

If addresses proceed sequentially from the head-end, this problem does not arise.

Note: The remote modem is able to turn on its carrier before receiving the start bit from the head-end. Because it has already incremented its own phase counter (see "overall system timing").

Overall System Timing (With Cable Delay Mod)


Head-end Transmit Data
S S 0 1 2 0 1 2 3 4 5 6 7 S S 0 1 2 0 1 2 3 4 5 6
Head-end Phase Counter Increment
"STB" Signal In Remote
"STRB" Signal In Remote
Remote Phase Counter Increment
Remote Transmit Data
S 0 1 2 3 4 5 6 7 S S 0 1 2 3 4 5 6 7 S
Remote Carrier Signal
Head-end Receive Interrupt ("DRDY")
←-Computer Service
Head-end Phase Counter Store

Notes:

1. The indicated events occur on bit or half-bit intervals (except for computer service).
2. "Computer Service" occurs when the program issues the instruction that clears the device flag.
3. When the remote phase counters increment, they are set to address "N + 1" before address "N" sends its data. Thus modem "N + 1" knows that it will be next, and can turn on its carrier before receiving the head-end's start bit.
4. Transmission delays due to a long cable cause the events in the remote modems to move to the right on the timing diagram.

Appendix 14/ CR710 Ramp Controller Ramp Queue Override Function

1. Switching Between Local Operation Mode and Remote Control Operation Mode

The ramp controller ramp queue override feature shall be in active state when the controller is operating in local operation mode.. The ramp queue override feature shall be in dormant state when the controller is operating under remote computer control. The HOLD-ON-LINE command bit transmitted by the traffic control computer shall be the mechanism to switch the ramp controller between local operation mode and remote control operation mode. The HOLD-ON-LINE command bit shall remain in effect for three s once it has been received by the ramp controller.

2. Ramp Queue Override Feature Under Remote Control Operation Mode.

When the ramp controller is switched to remote control operation mode, the ramp queue override feature shall be automatically deactivated, i.e., in dormant state.

3. Ramp Queue Override Feature Under Local Control Operation Mode.

The ramp controller shall be able to input from one (1) to two (2) ramp queue detectors. If the occupancy of any one of the queue detectors is exceeding a preset threshold value T1, which is corresponding to the maximum allowable queue length, the the current cycle length of the ramp controller is changed to the next lowest cycle length. If the condition persists for "T3" seconds following the cycle length change, another cycle length reduction will take place. This cycle length reduction continues until the minimum cycle length is reached, or until the occupancy of the queue detector is decreasing to below a preset threshold value T2, which is corresponding to the minimum acceptable queue length. If the present controller cycle length is already operating at minimum cycle length, then the cycle length reduction shall not cause a non-metering condition.

After the queue detector occupancy is decreasing to below the threshold value T2, the metering rate of the ramp controller shall again respond to the mainline freeway occupancy level. If the queue detector fails, the queue override function shall be disabled.

4. Setting of Queue Override Function Threshold Value T1, T2 and T3.

Due to ramp geometrics and traffic demand difference, it is necessary that the threshold occupancy values T1, T2 and T3 can be set up in the ramp controller's variable function table through keyboard entries. When T1 and T2 are equal to zero, the ramp queue override feature shall be automatically in the dormant state regardless of whether the ramp controller is operating in the local control operation mode or remote control operating mode.

Appendix 15/ CR710 Interface Functional Assignment

Interface Requirements Between the QEW FSCS Traffic Control Computer and the CR710 Microprocessor Ramp Controller.

1. 8 - Status Bits to Traffic Control Computer.

Bit	Function
0	Occupancy status
1	Cycle length status
2	Cycle length status
3	Cycle length status
4	Demand pretimed
5	Passage pretimed
6	Spare
7	Spare

where

(1) Cycle length status

000 - Non metering
001 - Cycle length, 1A
010 - Cycle length, 2A
011 - Cycle length, 3A
100 - Cycle length, 1B
101 - Cycle length, 2B
110 - Cycle length, 3B
111 - Manual cycle length

(2) Demand pretimed

0 - Pretimed
1 - Actuated

(3) Passage pretimed

0 - Pretimed
1 - Actuated

(4) Occupancy

0 - Occupancy not called for
1 - Occupancy called for

2. 8 - Command Bits to Microprocessor Ramp Controller

There can be from one to four 8-bit command messages sent to microprocessor ramp controller.

Message 1

Bit	Function
0	Hold on Line (HOL)
1	Cycle length desired
2	Cycle length desired
3	Cycle length desired
4	Demand pretimed
5	Passage pretimed
6	"0" 1st Message Address
7	"0" 1st Message Address

Message 2

Bit	Function
0	HOL
1	Least Significant cycle length digit (BCD)
2	Least Significant cycle length digit (BCD)
3	Least Significant cycle length digit (BCD)
4	Least Significant cycle length digit (BCD)
5	- -
6	"1" 2nd Message Address
7	"0" 2nd Message Address

Message 3

Bit	Function
0	HOL
1	Middle cycle length digit (BCD)
2	Middle cycle length digit (BCD)
3	Middle cycle length digit (BCD)
4	Middle cycle length digit (BCD)
5	- -
6	"0" 3rd Message Address
7	"1" 3rd Message Address

Message 4

Bit	Function
0	HOL
1	Most significant cycle length digit (BCD)
2	Most significant cycle length digit (BCD)
3	Most significant cycle length digit (BCD)
4	Most significant cycle length digit (BCD)
5	- -
6	"1" 4th Message Address
7	"1" 4th Message Address

where

(1) HOL (The amount of time that the controller will remain on line without a command is set at 3 s.)
0 - Do Not Hold on Line
1 - Hold on Line

(2) Cycle length desired
Same code as cycle length status in Section 1.

(3) Demand pretimed
0 - Pretimed
1 - Actuated

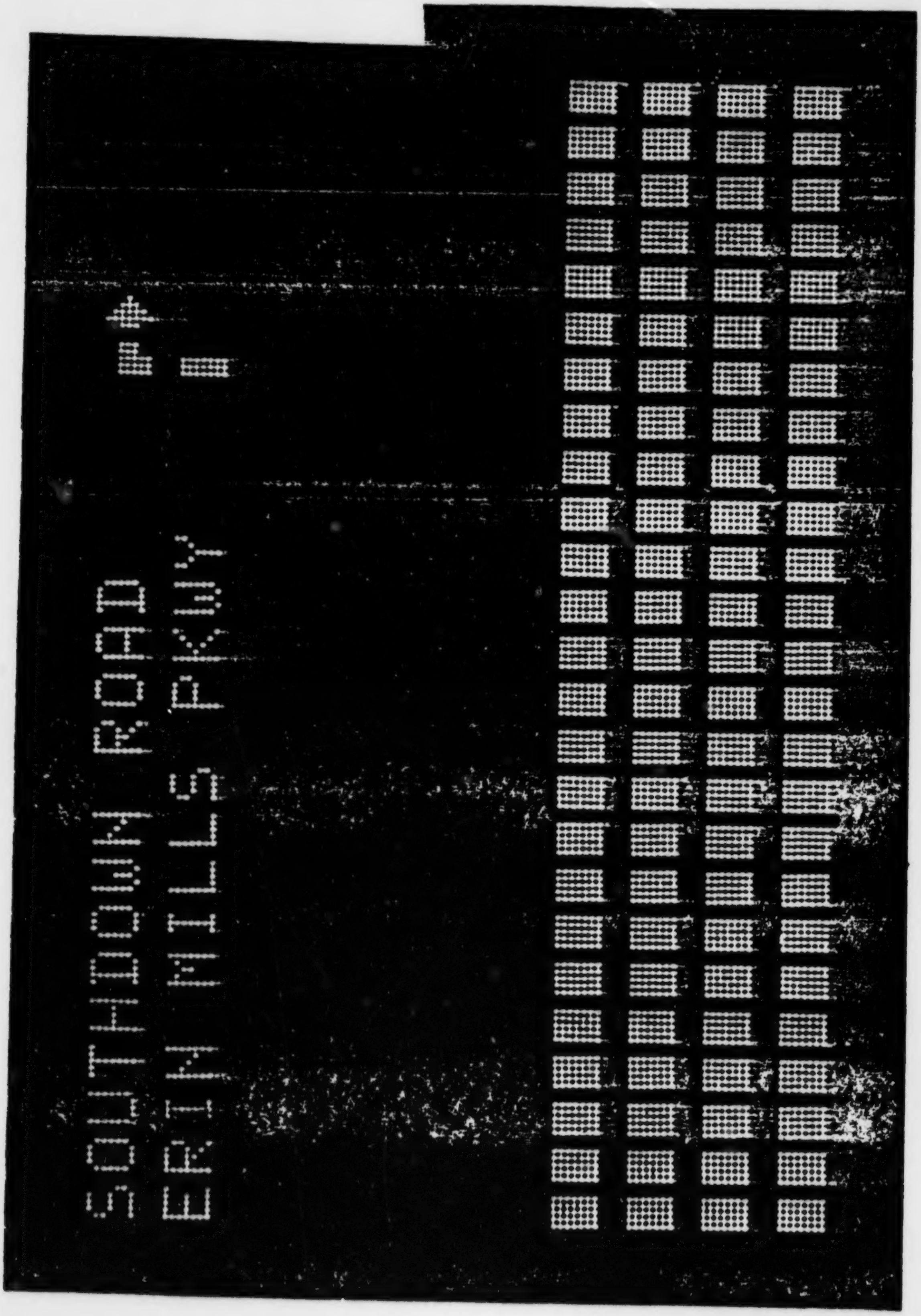
(4) Passage pretimed
0 - Pretimed
1 - Actuated

(5) Message address
00 - 1st Message
01 - 2nd Message
10 - 3rd Message
11 - 4th Message

(6) Cycle length digits (BCD)

BCD	DECIMAL
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9

Appendix 16/ Sample Sign Display and Sign Style



Appendix 17/ CMS Sign Character Symbol and ASCII Code

Bits				b7 → b6 → b5 →	0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1
b4	b3	b2	b1	COLUMN → ROW ↓	0	1	2	3	4	5
0	0	0	0	0	NUL*	DLE*		0	▮	P
0	0	0	1	1	SOH	DC1*	!	1	A	Q
0	0	1	0	2	STX	DC2*	"	2	B	R
0	0	1	1	3	ETX	DC3*	#	3	C	S
0	1	0	0	4	EOT	DC4*	$	4	D	T
0	1	0	1	5	ENQ*	NAK*	%	5	E	U
0	1	1	0	6	ACK*	SYN*	&	6	F	V
0	1	1	1	7	BEL	ETB*	◡	7	G	W
1	0	0	0	8	BS	CAN*	◢	8	H	X
1	0	0	1	9	HT	EM*	◣	9	I	Y
1	0	1	0	10	LF	SUB*	↙	▪▪	J	Z
1	0	1	1	11	VT	ESC*	•••	=	K	◀
1	1	0	0	12	FF*	FS*	◤	↓	L	◥
1	1	0	1	13	CR	GS*	—	⧗	M	▶
1	1	1	0	14	SO*	RS*	■	↘	N	--
1	1	1	1	15	SI*	US*	/	?	O	★

BEL - Cursor † home
BS - Cursor † left
HT - Cursor † right
SOH - Start of heading
STX - Start of text
ETX - End of text
EOT - End of transmission

LF - Cursor † down
VT - Cursor † up
CR - Cursor † to beginning of line

* - Character is ignored
† - Cursor indicates the character address position

Appendix 18/ CMS Controller Input Message Format and The CMS Controller Response.

The changeable message sign controller accepts the following input message format:

$$\text{SOH}\quad \underbrace{\text{BD}\quad \text{PNL}\quad \text{LN}}_{\text{Address portion}}\quad \text{MDL}\quad \text{STX}\ \underbrace{\text{Data characters}}_{\text{Data portion}}\ \text{ETX}$$

where

SOH - start of heading. Upon receiving this character, the board, panel, line, and module addresses shall be reset to zero. The character address position moves to the upper left corner of the "BOARD".

BD - Board Address with the following ASCII address characters assigned:

P - Board 0
Q - Board 1
R - Board 2
S - Board 3
T - Board 4

PNL - Panel address with the following ASCII address characters assigned:

0 - Panel 0
1 - Panel 1
2 - Panel 2
3 - Panel 3
4 - Panel 4
5 - Panel 5
6 - Panel 6
7 - Panel 7

LN - Line address with the following ASCII address characters assigned:

@ - Line 0
A - Line 1
B - Line 2
C - Line 3
D - Line 4
E - Line 5
F - Line 6
G - Line 7
H - Line 8

I - Line 9
J - Line 10
K - Line 11
L - Line 12
M - Line 13
N - Line 14
O - Line 15

MDL - Module Address with the following ASCII address characters assigned:

0 - Module 0
1 - Module 1
2 - Module 2
3 - Module 3
4 - Module 4
5 - Module 5
6 - Module 6
7 - Module 7
8 - Module 8
9 - Module 9

STX - Start of text

ETX - Terminate the message. All following characters will be ignored until either an SOH or BEL is received.

The following special control characters shall be accepted by the controller when used in the Data Portion of the message.

BEL - This character shall be regarded as "Home" character by the sign controller. The Board address remains the same but PANEL, LINE, and MODULE addresses are reset to zero. The character address position moves to the upper left corner of the "BOARD".

CR - The "CARRIAGE RETURN" character shall set both PANEL and MODULE addresses to zero. The character address position shall move to the character at the extreme left of a line.

LF - The "LINE FEED" character shall increment the line address. If the "character address portion" is on the bottom line, it shall recycle to TOP LINE (LINE 0).

VT - This "VERTICAL TAB" character shall decrement the LINE address. If the "character address portion" is on the TOP LINE, it shall recycle to BOTTOM LINE.

BS - This "BACK SPACE" character shall decrement the MODULE address. The "character address position" shall move left one character module position. If the MODULE ADDRESS is 0, it shall decrement PANEL address and shall set MODULE address to 9. If the "character address position" is on PANEL 0, MODULE 0, the "character address position" shall recycle to the last PANEL, last MODULE on the LINE above the original line (right most character module, up one line). If the "character address position" is on PANEL 0, LINE 0, MODULE 0, the "character address position" shall recycle to last PANEL, last MODULE, and last LINE (lower right most character module in the board).

HT - This "HORIZONTAL TAB" character shall increment the MODULE address, (all functions shall be the opposite of BS item).

ENQ - This "ENQ" character shall serve as "blankout" control character. Upon receiving this character, the sign controller shall blank out the Changeable Message Sign.

Note: An automatic CR/LF shall be performed by the sign controller at the end of the last character on a LINE.

The present CMS control program utilizes the following message format:

SOH P 0 @ 0 STX .... CR LF .... ETX

or

SOH BEL .... CR LF .... ETX

Response of Sign Controller to "ENQ" and "SOH"

When the sign controller receives an "ENQ",

- the echo data line goes immediately to a "BREAK" condition -- the "ENQ" is not echoed.
- the "BREAK" clears automatically in 6 s, and the controller is then ready to receive more characters.

When the sign controller asserts a "BREAK" condition on the echo data line

- if the "BREAK" was due to a parity error, the sign is not blanked.
- if the "BREAK" was due to something other than a parity error, the sign is blanked.

When the sign controller receives an "SOH" while in a "BREAK" condition:

1. If the "BREAK" was due to a parity error:
   - the "BREAK" will clear immediately.
   - the "SOH" will be echoed back.

   - the controller is ready for more characters immediately.
2. If the "BREAK" was due to something other than a parity error:
   - the "SOH" is not echoed
   - the "BREAK" persists after the "SOH" is received.

Computer-Computer Interface for "ENQ" and "SOH" Messages

"ENQ" and "SOH" messages from the host computer will be sent in the protocol 4 buffer only as one-byte message of the following form:

High BYTE	Low BYTE
0	ADDR
CHAR	0

where:

- "ADDR" is the modem address.
- "CHAR" is an "ENQ" or "SOH".

This message may be preceded by or followed by other messages in the protocol 4 buffer.

The response in the Protocol 5 buffer will be a 1-byte message of the same form, where "CHAR" is as defined below.

"ENQ" Message From Host

Echo From Sign Controller	"CHAR" In Prot 5 Buffer	Message Status
Break	NAK	0 (Correct)
CHAR other than Break	ENQ	1 (Error)
No response	0	1 (Error)

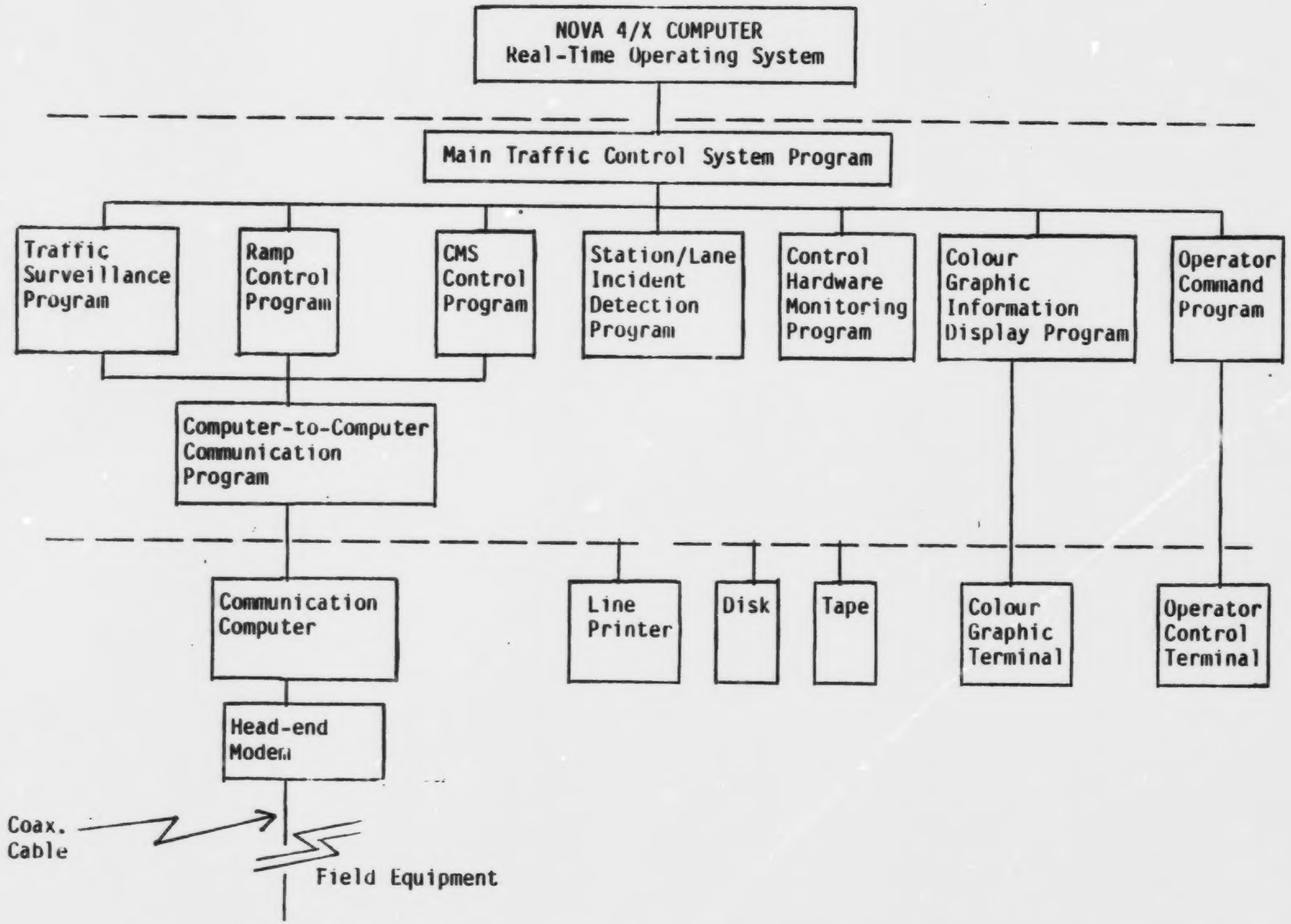
"SOH" Message From Host

The cable network processor assumes that the host will only send an "SOH" to try to clear a "BREAK", and processes the echoed message accordingly. When an "SOH" is sent, it will take about 5 s before the protocol 5 buffer is ready.

Echo From Sign Controller	"CHAR" In Prot 5 Buffer	Message Status
Break Clears	SOH	0 (Correct)
Break Persists	NAK	1 (Error)
Some other CHAR	That CHAR	1 (Error)

Appendix 19/ CMS Controller and Data Modem Interface

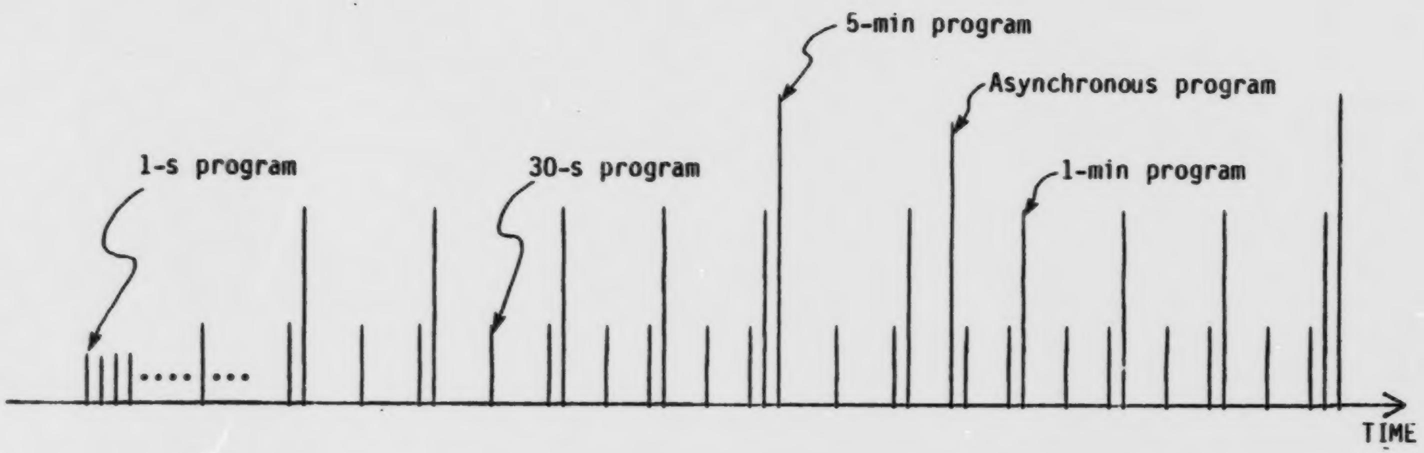
Pin Number	Description
2	Feedback or echo signal from sign controller to remote data modem
3	Character data signal from remote modem to sign controller
4	Request to send
7	Signal ground
8	Received Line Carrier signal Detector.


NOVA 4/X COMPUTER
Real-Time Operating System
Main Traffic Control System Program
Traffic Surveillance Program
Ramp Control Program
CMS Control Program
Station/Lane Incident Detection Program
Control Hardware Monitoring Program
Colour Graphic Information Display Program
Operator Command Program
Computer-to-Computer Communication Program
Communication Computer
Head-end Modem
Line Printer
Disk
Tape
Colour Graphic Terminal
Operator Control Terminal
Coax. Cable
Field Equipment

Appendix 20/ QEW FSCS REAL-TIME TRAFFIC CONTROL SOFTWARE FUNCTIONAL BLOCK DIAGRAM

Appendix 21/ RAMP CONTROLLER LOCATIONS

Number	Location	Type	Modem Address (Octal)	CNTADR (Decimal)
1	Cawthra N/B	type 170	104	68
2	Cawthra S/B	type 170	104	68
3	Highway 10 N/B	CR 710	10	8
4	Highway 10 S/B	CR 710	14	12
5	Mississauga N/B	CR 710	24	20
6	Mississauga S/B	CR 710	30	24
7	Southdown Road	CR 710	40	32
8	Winston Churchill N/B	type 170	50	40
9	Winston Churchill S/B	type 170	50	40
10	Ford Drive	type 170	60	48



Appendix 22/ Real-Time Multi-Task Program Scheduling Sequence

Appendix 23/ "Detect" Traffic Data Buffer

In the traffic data buffer, raw input data from each modem is followed by volume (VOL) and elapsed time (ET) calculations for each detector point (DX) attached to that modem. For double detectors, the double detector elapsed time (DDET) follows the VOL and ET calculations for each detector pair. For modems attached to double detectors, the high byte of each word storing input data is marked with * to indicate that the byte is used by the BDCSP program for storing flags used in processing double detector elapsed time.

Each input point is attached to one bit in the input byte from a modem. VOL and ET calculations proceed in order from least significant bit to most significant bit. For example, for modem address 12, D1 is assigned to bit 0, D2 to bit 1, D5 to bit 2, and D7 to bit 3.

```
                                              Modem
               High     Low                   address   Input           # Input
Word #         byte     byte                  (octal)   type            points
------         ----     ----                  -------   -----           -------
           15        8  7          0
          +-------------+-------------+
   1      ! Load     C1 ! CR710    C1 !       10-11     Controller      (8)
   2      ! switch   C2 ! status   C2 !       14-15     inputs
   3      ! status   C3 !          C3 !       24-25
   4      !          C4 !          C4 !       30-31
   5      !          C5 !          C5 !       40-41
   6      !          C6 !          C6 !       50-51
   7      !          C7 !          C7 !       60-61
   8      !          C8 !          C8 !       104-105
          +-------------+-------------+
   9      !             ! Input data  !       12        Single          (4)
          +-------------+-------------+                 detector
  10      !          VOL - D1         !                 inputs
  11      !          ET  - D1         !
  12      !          VOL - D2         !
  13      !          ET  - D2         !
  14      !          VOL - D5         !
  15      !          ET  - D5         !
  16      !          VOL - D7         !
  17      !          ET  - D7         !
          +-------------+-------------+
  18      !             ! Input data  !       16        Single          (5)
          +-------------+-------------+                 detector
  19      !          VOL - D3         !
  20      !          ET  - D3         !
  21      !          VOL - D4         !
  22      !          ET  - D4         !
  23      !          VOL - D6         !
  24      !          ET  - D6         !
  25      !          VOL - D8         !
  26      !          ET  - D8         !
  27      !          VOL - D9         !
  28      !          ET  - D9         !
```

Appendix 23/ (Cont'd)

29		Input data	26	Single detector	(5)
30		VOL - D28			
31		ET - D28			
32		VOL - D29			
33		ET - D29			
34		VOL - D30			
35		ET - D30			
36		VOL - D36			
37		ET - D36			
38		VOL - D37			
39		ET - D37			
40		Input data	32	Single detector	(5)
41		VOL - D31			
42		ET - D31			
43		VOL - D32			
44		ET - D32			
45		VOL - D33			
46		ET - D33			
47		VOL - D34			
48		ET - D34			
49		VOL - D35			
50		ET - D35			
51		Input data	42	Single detector	(4)
52		VOL - D68			
53		ET - D68			
54		VOL - D69			
55		ET - D69			
56		VOL - D70			
57		ET - D70			
58		VOL - D77			
59		ET - D77			

Appendix 23/ (Cont'd)

```
          +-----------------+-----------------+
 60       !                 ! Input data !      52       Single          (8)
          +-----------------+-----------------+          detector
 61       !                    VOL  - D91 !
 62       !                    ET   - D91 !
 63       !                    VOL  - D92 !
 64       !                    ET   - D92 !
 65       !                    VOL  - D93 !
 66       !                    ET   - D93 !
 67       !                    VOL  - D94 !
 68       !                    ET   - D94 !
 69       !                    VOL  - D95 !
 70       !                    ET   - D95 !
 71       !                    VOL  - D96 !
 72       !                    ET   - D96 !
 73       !                    VOL  - D97 !
 74       !                    ET   - D97 !
 75       !                    VOL  - D98 !
 76       !                    ET   - D98 !
          +-----------------+-----------------+
 77       !                 ! Input data !      62       Single          (4)
          +-----------------+-----------------+          detector
 78       !                    VOL  - D113!
 79       !                    ET   - D113!
 80       !                    VOL  - D114!
 81       !                    ET   - D114!
 82       !                    VOL  - D115!
 83       !                    ET   - D115!
 84       !                    VOL  - D116!
 85       !                    ET   - D116!
          +-----------------+-----------------+
 86       !                 ! Input data !      66       Single          (2)
          +-----------------+-----------------+          detector
 87       !                    VOL  - D135!
 88       !                    ET   - D135!
 89       !                    VOL  - D136!
 90       !                    ET   - D136!
          +-----------------+-----------------+
 91       !                 ! Input data !      102      Single          (2)
          +-----------------+-----------------+          detector
 92       !                    VOL  - D519!
 93       !                    ET   - D519!
 94       !                    VOL  - D520!
 95       !                    ET   - D520!
```

Appendix 23/ (Cont'd)

96		Input data	106	Single detector	(6)
97		VOL - D513			
98		ET - D513			
99		VOL - D514			
100		ET - D514			
101		VOL - D515			
102		ET - D515			
103		VOL - D516			
104		ET - D516			
105		VOL - D517			
106		ET - D517			
107		VOL - D518			
108		ET - D518			
109	*	Input data	17	Double detector	(3 pairs)
110		VOL - D10			
111		ET - D10			
112		VOL - D11			
113		ET - D11			
114		DDET - D10, D11			
115		VOL - D12			
116		ET - D12			
117		VOL - D13			
118		ET - D13			
119		DDET - D12, D13			
120		VOL - D14			
121		ET - D14			
122		VOL - D15			
123		ET - D15			
124		DDET - D14, D15			
125	*	Input data	20	Double detector	(3 pairs)
126		VOL - D16			
127		ET - D16			
128		VOL - D17			
129		ET - D17			
130		DDET - D16, D17			
131		VOL - D18			
132		ET - D18			
133		VOL - D19			
134		ET - D19			
135		DDET - D18, D19			
136		VOL - D20			
137		ET - D20			
138		VOL - D21			
139		ET - D21			
140		DDET - D20, D21			

Appendix 23/ (Cont'd)

```
        +---------------+--------------+
 141    !      *        ! Input data   !      21      Double            (3 pairs)
        +---------------+--------------+              detector
 142    !                    VOL - D22 !
 143    !                    ET  - D22 !
 144    !                    VOL - D23 !
 145    !                    ET  - D23 !
 146    !             DDET - D22, D23  !
 147    !                    VOL - D24 !
 148    !                    ET  - D24 !
 149    !                    VOL - D25 !
 150    !                    ET  - D25 !
 151    !             DDET - D24, D25  !
 152    !                    VOL - D26 !
 153    !                    ET  - D26 !
 154    !                    VOL - D27 !
 155    !                    ET  - D27 !
 156    !             DDET - D26, D27  !
        +---------------+--------------+
 157    !      *        ! Input data   !      33      Double            (3 pairs)
        +---------------+--------------+              detector
 158    !                    VOL - D38 !
 159    !                    ET  - D38 !
 160    !                    VOL - D39 !
 161    !                    ET  - D39 !
 162    !             DDET - D38, D39  !
 163    !                    VOL - D40 !
 164    !                    ET  - D40 !
 165    !                    VOL - D41 !
 166    !                    ET  - D41 !
 167    !             DDET - D40, D41  !
 168    !                    VOL - D42 !
 169    !                    ET  - D42 !
 170    !                    VOL - D43 !
 171    !                    ET  - D43 !
 172    !             DDET - D42, D43  !
        +---------------+--------------+
 173    !      *        ! Input data   !      34      Double            (3 pairs)
        +---------------+--------------+              detector
 174    !                    VOL - D44 !
 175    !                    ET  - D44 !
 176    !                    VOL - D45 !
 177    !                    ET  - D45 !
 178    !             DDET - D44, D45  !
 179    !                    VOL - D46 !
 180    !                    ET  - D46 !
 181    !                    VOL - D47 !
 182    !                    ET  - D47 !
 183    !             DDET - D46, D47  !
 184    !                    VOL - D48 !
 185    !                    ET  - D48 !
 186    !                    VOL - D49 !
 187    !                    ET  - D49 !
 188    !             DDET - D48, D49  !
```

Appendix 23/ (Cont'd)

189	*	Input data	35	Double detector	(3 pairs)
190		VOL - D50			
191		ET - D50			
192		VOL - D51			
193		ET - D51			
194		DDET - D50, D51			
195		VOL - D52			
196		ET - D52			
197		VOL - D53			
198		ET - D53			
199		DDET - D52, D53			
200		VOL - D54			
201		ET - D54			
202		VOL - D55			
203		ET - D55			
204		DDET - D54, D55			
205	*	Input data	36	Double detector	(3 pairs)
206		VOL - D56			
207		ET - D56			
208		VOL - D57			
209		ET - D57			
210		DDET - D56, D57			
211		VOL - D58			
212		ET - D58			
213		VOL - D59			
214		ET - D59			
215		DDET - D58, D59			
216		VOL - D60			
217		ET - D60			
218		VOL - D61			
219		ET - D61			
220		DDET - D60, D61			
221	*	Input data	37	Double detector	(3 pairs)
222		VOL - D62			
223		ET - D62			
224		VOL - D63			
225		ET - D63			
226		DDET - D62, D63			
227		VOL - D64			
228		ET - D64			
229		VOL - D65			
230		ET - D65			
231		DDET - D64, D65			
232		VOL - D66			
233		ET - D66			
234		VOL - D67			
235		ET - D67			
236		DDET - D66, D67			

Appendix 23/ (Cont'd)

```
        +------------+------------+
237     !     *      ! Input data !       43        Double             (3 pairs)
        +------------+------------+                 detector
238     !                VOL - D71 !
239     !                ET  - D71 !
240     !                VOL - D72 !
241     !                ET  - D72 !
242     !          DDET - D71,D72 !
243     !                VOL - D73 !
244     !                ET  - D73 !
245     !                VOL - D74 !
246     !                ET  - D74 !
247     !          DDET - D73,D74 !
248     !                VOL - D75 !
249     !                ET  - D75 !
250     !                VOL - D76 !
251     !                ET  - D76 !
252     !          DDET - D75,D76 !
        +------------+------------+
253     !     *      ! Input data !       45        Double             (4 pairs)
        +------------+------------+                 detector
254     !                VOL - D78 !
255     !                ET  - D78 !
256     !                VOL - D79 !
257     !                ET  - D79 !
258     !          DDET - D78,D79 !
259     !                VOL - D80 !
260     !                ET  - D80 !
261     !                VOL - D81 !
262     !                ET  - D81 !
263     !          DDET - D80,D81 !
264     !                VOL - D82 !
265     !                ET  - D82 !
266     !                VOL - D83 !
267     !                ET  - D83 !
268     !          DDET - D82,D83 !
269     !                VOL - D840! (dummy)
270     !                ET  - D840! (dummy)
271     !                VOL - D84 !
272     !                ET  - D84 !
273     !        DDET - D840,D84 ! (dummy)
```

Appendix 23/ (Cont'd)

```
          +-----------------+-----------------+
 274      !       *         ! Input data      !        46         Double               (3 pairs)
          +-----------------+-----------------+                   detector
 275      !                       VOL  - D85  !
 276      !                       ET   - D85  !
 277      !                       VOL  - D86  !
 278      !                       ET   - D86  !
 279      !                DDET  - D85, D86   !
 280      !                       VOL  - D87  !
 281      !                       ET   - D87  !
 282      !                       VOL  - D88  !
 283      !                       ET   - D88  !
 284      !                DDET  - D87, D88   !
 285      !                       VOL  - D89  !
 286      !                       ET   - D89  !
 287      !                       VOL  - D90  !
 288      !                       ET   - D90  !
 289      !                DDET  - D89, D90   !
          +-----------------+-----------------+
 290      !       *         ! Input data      !        53         Double               (3 pairs)
          +-----------------+-----------------+                   detector
 291      !                       VOL  - D99  !
 292      !                       ET   - D99  !
 293      !                       VOL  - D100!
 294      !                       ET   - D100!
 295      !              DDET  -   D99, D100!
 296      !                       VOL  - D101!
 297      !                       ET   - D101!
 298      !                       VOL  - D102!
 299      !                       ET   - D102!
 300      !              DDET  - D101, D102!
 301      !                       VOL  - D103!
 302      !                       ET   - D103!
 303      !                       VOL  - D104!
 304      !                       ET   - D104!
 305      !              DDET  - D103, D104!
```

Appendix 23/ (Cont'd)

```
     +--------------+------------+
306  !      *       ! Input data !     54      Double           (4 pairs)
     +--------------+------------+             detector
307  !                VOL - D105!
308  !                ET  - D105!
309  !                VOL - D106!
310  !                ET  - D106!
311  !          DDET - D105,D106!
312  !                VOL - D107!
313  !                ET  - D107!
314  !                VOL - D108!
315  !                ET  - D108!
316  !          DDET - D107,D108!
317  !                VOL - D109!
318  !                ET  - D109!
319  !                VOL - D110!
320  !                ET  - D110!
321  !          DDET - D109,D110!
322  !                VOL - D111!
323  !                ET  - D111!
324  !                VOL - D112!
325  !                ET  - D112!
326  !          DDET - D111,D112!
     +--------------+------------+
327  !      *       ! Input data !     63      Double           (3 pairs)
     +--------------+------------+             detector
328  !                VOL - D117!
329  !                ET  - D117!
330  !                VOL - D118!
331  !                ET  - D118!
332  !          DDET - D117,D118!
333  !                VOL - D119!
334  !                ET  - D119!
335  !                VOL - D120!
336  !                ET  - D120!
337  !          DDET - D119,D120!
338  !                VOL - D121!
339  !                ET  - D121!
340  !                VOL - D122!
341  !                ET  - D122!
342  !          DDET - D121,D122!
```

Appendix 23/ (Cont'd)

```
           +-------------+-------------+
 343       !      *      ! Input data  !      64        Double           (3 pairs)
           +-------------+-------------+                detector
 344       !                 VOL - D123!
 345       !                 ET  - D123!
 346       !                 VOL - D124!
 347       !                 ET  - D124!
 348       !          DDET - D123,D124!
 349       !                 VOL - D125!
 350       !                 ET  - D125!
 351       !                 VOL - D126!
 352       !                 ET  - D126!
 353       !          DDET - D125,D126!
 354       !                 VOL - D127!
 355       !                 ET  - D127!
 356       !                 VOL - D128!
 357       !                 ET  - D128!
 358       !          DDET - D127,D128!
           +-------------+-------------+
 359       !      *      ! Input data  !      65        Double           (3 pairs)
           +-------------+-------------+                detector
 360       !                 VOL - D129!
 361       !                 ET  - D129!
 362       !                 VOL - D130!
 363       !                 ET  - D130!
 364       !          DDET - D129,D130!
 365       !                 VOL - D131!
 366       !                 ET  - D131!
 367       !                 VOL - D132!
 368       !                 ET  - D132!
 369       !          DDET - D131,D132!
 370       !                 VOL - D133!
 371       !                 ET  - D133!
 372       !                 VOL - D134!
 373       !                 ET  - D134!
 374       !          DDET - D133,D134!
           +-------------+-------------+
 375       !      *      ! Input data  !      70        Double           (3 pairs)
           +-------------+-------------+                detector
 376       !                 VOL - D137!
 377       !                 ET  - D137!
 378       !                 VOL - D138!
 379       !                 ET  - D138!
 380       !          DDET - D137,D138!
 381       !                 VOL - D139!
 382       !                 ET  - D139!
 383       !                 VOL - D140!
 384       !                 ET  - D140!
 385       !          DDET - D139,D140!
 386       !                 VOL - D141!
 387       !                 ET  - D141!
 388       !                 VOL - D142!
 389       !                 ET  - D142!
 390       !          DDET - D141,D142!
```

```
        Appendix 23/ (Cont'd)

        +--------------+-------------+
 391    !      *       ! Input data  !        71        Double            (3 pairs)
        +--------------+-------------+                  detector
 392    !                 VOL - D143!
 393    !                 ET  - D143!
 394    !                 VOL - D144!
 395    !                 ET  - D144!
 396    !          DDET - D143,D144!
 397    !                 VOL - D145!
 398    !                 ET  - D145!
 399    !                 VOL - D146!
 400    !                 ET  - D146!
 401    !          DDET - D145,D146!
 402    !                 VOL - D147!
 403    !                 ET  - D147!
 404    !                 VOL - D148!
 405    !                 ET  - D148!
 406    !          DDET - D147,D148!
        +--------------+-------------+
 407    !      *       ! Input data  !        100       Double            (3 pairs)
        +--------------+-------------+                  detector
 408    !                 VOL - D501!
 409    !                 ET  - D501!
 410    !                 VOL - D502!
 411    !                 ET  - D502!
 412    !          DDET - D501,D502!
 413    !                 VOL - D503!
 414    !                 ET  - D503!
 415    !                 VOL - D504!
 416    !                 ET  - D504!
 417    !          DDET - D503,D504!
 418    !                 VOL - D505!
 419    !                 ET  - D505!
 420    !                 VOL - D506!
 421    !                 ET  - D506!
 422    !          DDET - D505,D506!
        +--------------+-------------+
 423    !      *       ! Input data  !        101       Double            (3 pairs)
        +--------------+-------------+                  detector
 424    !                 VOL - D507!
 425    !                 ET  - D507!
 426    !                 VOL - D508!
 427    !                 ET  - D508!
 428    !          DDET - D507,D508!
 429    !                 VOL - D509!
 430    !                 ET  - D509!
 431    !                 VOL - D510!
 432    !                 ET  - D510!
 433    !          DDET - D509,D510!
 434    !                 VOL - D511!
 435    !                 ET  - D511!
 436    !                 VOL - D512!
 437    !                 ET  - D512!
 438    !          DDET - D511,D512!
```

```
        Appendix 23/ (Cont'd)

        +------------+------------+
 439    !     *      ! Input data !      107      Double           (3 pairs)
        +------------+------------+                detector
 440    !                VOL - D521!
 441    !                ET  - D521!
 442    !                VOL - D522!
 443    !                ET  - D522!
 444    !         DDET - D521,D522!
 445    !                VOL - D523!
 446    !                ET  - D523!
 447    !                VOL - D524!
 448    !                ET  - D524!
 449    !         DDET - D523,D524!
 450    !                VOL - D525!
 451    !                ET  - D525!
 452    !                VOL - D526!
 453    !                ET  - D526!
 454    !         DDET - D525,D526!
        +------------+------------+
 455    !     *      ! Input data !      110      Double           (3 pairs)
        +------------+------------+                detector
 456    !                VOL - D527!
 457    !                ET  - D527!
 458    !                VOL - D528!
 459    !                ET  - D528!
 460    !         DDET - D527,D528!
 461    !                VOL - D529!
 462    !                ET  - D529!
 463    !                VOL - D530!
 464    !                ET  - D530!
 465    !         DDET - D529,D530!
 466    !                VOL - D531!
 467    !                ET  - D531!
 468    !                VOL - D532!
 469    !                ET  - D532!
 470    !         DDET - D531,D532!
```

Appendix 23/ (Cont'd)

471	Modem response counts	0
472		1
473		2
474		3
475		4
476		5
477		6
478		7
479		10
480		11
481		12
482		13
483		14
484		15
485		16
486		17
487		20
488		21
489		22
490		23
491		24
492		25
493		26
494		27
495		30
496		31
497		32
498		33
499		34
500		35
501		36
502		37
503		40
504		41
505		42
506		43
507		44
508		45
509		46
510		47
511		50
512		51
513		52
514		53
515		54
516		55
517		56
518		57
519		60
520		61
521		62
522		63
523		64
524		65

Appendix 23/ (Cont'd)

```
525    !                         !      66
526    !                         !      67
527    !                         !      70
528    !                         !      71
529    !                         !      72
530    !                         !      73
531    !                         !      74
532    !                         !      75
533    !                         !      76
534    !                         !      77
535    !                         !      100
536    !                         !      101
537    !                         !      102
538    !                         !      103
539    !                         !      104
540    !                         !      105
541    !                         !      106
542    !                         !      107
543    !                         !      110
       +-------------------------+
544    ! Sign echo message status!
       +-------------------------+
545    !     Transfer count      !
       +-------------------------+
```

Appendix 24/ "COMDOP" Ramp Control Command Buffer Format

Word	Left Byte	Right Byte	On-Ramp
1	Control data	Modem Address	Cawthra NB & SB
2	Control data	Modem Address	Highway 10 NB
3	Control data	Modem Address	Highway 10 SB
4	Control data	Modem Address	Mississauga NB
5	Control data	Modem Address	Mississauga SB
6	Control data	Modem Address	Southdown Road
7	Control data	Modem Address	Winston NB & SB
8	Control data	Modem Address	Ford Drive

The eight-word buffer, sent from the traffic control computer to the communication computer, holds control information for the ramp controllers. The left byte of each word holds the control data, and the right byte holds the modem address to receive that data. The communication computer precedes every word sent to a modem with a control code 3, which resets its local time out counter. The traffic control computer outputs to a modem at least every 3 s to prevent its controller from going into local control.

Appendix 25/ Computerized Ramp Metering Rate Selection Logic

1/ Introduction

Based on the experience from the implemented Minneapolis freeway control system and the recommendation from the project consultant Dr. Brian L. Allen, the following coordinated ramp metering rate selection logic is drafted. This logic is intended to be implemented as the first phase ramp control logic on the traffic control computer (Nova 800 system). It is expected that this computerized ramp control logic will be improved as the experience is gained from the real system operation.

2/ Traffic Control Section

Due to the fact that each interchange is unique in geometrics, demand, and relation to the entire traffic corridor, the freeway is divided into three (3) control sections according to the interchange boundary. The purpose of the control section is to determine the location of the decision variable, i.e., volume and occupancy, for each entrance ramp control strategy. Figure 1 shows the proposed traffic control section (adapted from consultant proposal) according to the availability of the hardware facilities. From Figure 1, it is clear that the metering rate of an entrance ramp will not only be determined by the nearby local detector station data but will also be determined by its upstream and downstream detector station data. Basically, this is to achieve the function of the coordinated ramp control system.

3/ Ramp Characteristics Table

For the purpose of the ramp metering rate selection within a control section, a characteristics table (RAMTAB) for all ramps which are available for entrance control will be made up of the station numbers of the ramp's local, upstream and downstream detector stations. These station numbers will be used as the index pointer to access the real-time detector data and ramp cycle length selection table.

Figure 2 shows the system ramp characteristics table. The numbers shown in the Figure 2 is an example of the traffic control section configuration.

4/ Ramp Cycle Length Selection Table

The numerical threshold values used for real-time selection of metering rates are stored in the table 'CYCTAB' as shown in Figure 3. These values are the thresholds of occupancy for the local and downstream detector stations, the volume thresholds of upstream detector stations for each of the three control sections, and the associated cycle lengths for each of six different metering rates.

The values shown in the Figure 3 is an example of the mainline detector station volume and occupancy threshold value. Since the 'occupancy' is only an indication of the freeway congestion status, it is felt that the same set of the local station occupancy or downstream station occupancy threshold values can be used for all five entrance ramps. If one set of the occupancy threshold values is required for each entrance ramp control, the table 'CYCTAB' can be expanded to cover this situation.

5/ Real-time Mainline Detector Station Data Table

The mainline detector station data used for metering rate selection will be the latest 1-min running average occupancy by station and the latest 1-min running average volume by station. These 1-min running average volume and occupancy data will be updated every 30 s. Figure 4 shows the latest 1-min running average occupancy and volume table. Note that the data in the table will be changing depending on the real-time traffic situation.

6/ Ramp Controller Metering Rate Setting

The CR710 ramp controller's six-cycle length metering rates, which are selectable from the traffic control computer, will be pre-set locally according to each ramp's characteristics. For example, the setting of the CR710 controller's six metering rates can be made according to whether the ramp is a low, average, or high volume entrance ramp. In other words, it can be made according to the cumulative demand function for each entrance ramp. Figure 5 shows the example of the metering rate setting for the five ramp controllers.

7/ Ramp Control Period

It is generally practiced that the ramp control period be divided into three. In period 1, a ramp will be turned on only if warranted by the mainline traffic flow, that is, the real-time data exceeding the lowest volume or occupancy threshold value. In period 2, all the entrance ramps shall be available for coordinated ramp metering control. In period 3, a ramp will be turned off as mainline traffic flow drops off. Once a ramp is turned on, the rate at which vehicles are allowed to enter the freeway will remain responsive to the mainline traffic unless a traffic controller metering rate override command is exercised. In the latter case, the metering rate override command will remain effective until it is cancelled to relieve excessive ramp queue delay.

8/ The Selection of the Metering Rate

Throughout the control period when the ramp is active, the metering rate selection process will take place every 30 s, and the metering rate is changed if warranted by the mainline real-time traffic conditions.

As described above, there are three decision variables to select the metering rate, namely, local station occupancy, downstream station occupancy, and upstream station volume.

The actual selection process can be best illustrated by an example. For instance, on the Highway 10 Southbound entrance ramp, the associated local station number '9' is obtained from ramp characteristics table 'RAMTAB'. This local station number '9' is used as an index to obtain the latest 1-min running average occupancy data from mainline detector station data table (Figure 4). This real-time occupancy value, for example, 27%, is then compared with the occupancy threshold value in the ramp cycle length selection table 'CYCTAB' (Figure 3). It is found that '27%' falls between the threshold value '23%' and '30%'. Therefore, the corresponding cycle length '4' will be selected.

The same selection process will be repeated for the associated downstream station number '10'. For example, if the real-time occupancy value at the downstream station number '10' is found to be '35%', then the cycle length '5' will be chosen from the table 'CYCTAB'.

For the associated upstream station number '7', if the real-time volume value is found to be '78' vehicles, then the corresponding cycle length '3' will be selected from the table 'CYCTAB' because the Highway 10 Southbound ramp is in control section 3 (C.S.3).

It is obvious now that using three decision variables, i.e., local station occupancy, downstream station occupancy, and upstream station volume can result in three different cycle lengths to be chosen. In this example, they are cycle length '3', '4', and '5'.

In the case of isolated ramp control system (essentially only local station occupancy is used as decision variable), the cycle length '4' will be chosen.

The Minneapolis freeway control system will choose the longest cycle length, that is, '5'. This is a conservative approach to prevent the congestion from happening in the mainline freeway.

The project consultant, Dr. Allen, proposes to assign each decision process a weighting factor, then choosing the maximum one, or simply taking the average value; in this example, it will be cycle length '4'. Apparently, if the main objective of the freeway ramp control is to prevent the freeway congestion which could be due to excessive upstream volume influx, excessive local occupancy, or excessive downstream occupancy, then choosing the longest cycle length seems to be a logical approach.

In any event, if the selected cycle length is '5' for example, it will be transmitted by the communication system to the Highway 10 southbound ramp controller. The controller will then choose the 9-s as the next cycle length from its pre-set metering rate value (see Figure 5).

9/ Synchronization of The Ramp Controller and Traffic Control Computer

To avoid the problem that the CR710 ramp controller is dropped off-line too long, it is necessary to adjust the local timer in the CR710 controller to set up the same ramp control period as used by the traffic control computer.

10/ Handling of the Entrance Ramp Queue

Since excessive ramp queue delay is undesirable, provision will be made to relieve the excessive ramp queue length by metering rate override command from the operator console.

However, the local ramp controller shall also possess the ramp queue override feature which shall be automatically activated when it drops off-line from the computer system. This feature shall also be automatically de-activated when the controller goes on-line (connected to the computer system) such that only the computer can exercise the ramp queue override feature.

11/ Flexibility of the Ramp Metering Rate Selection Logic

Since this is a demonstration project, flexibility will be provided to allow for changing of the traffic control section, ramp characteristics table and cycle length selection table, such that different control concepts can be exercised and tested.

It is also expected that as a more sophisticated control algorithm is developed, the preceding ramp metering rate selection logic will be replaced.

TIME - HH:MM:SS/DD:MM:YY
WEATHER -

(Appendix 25)

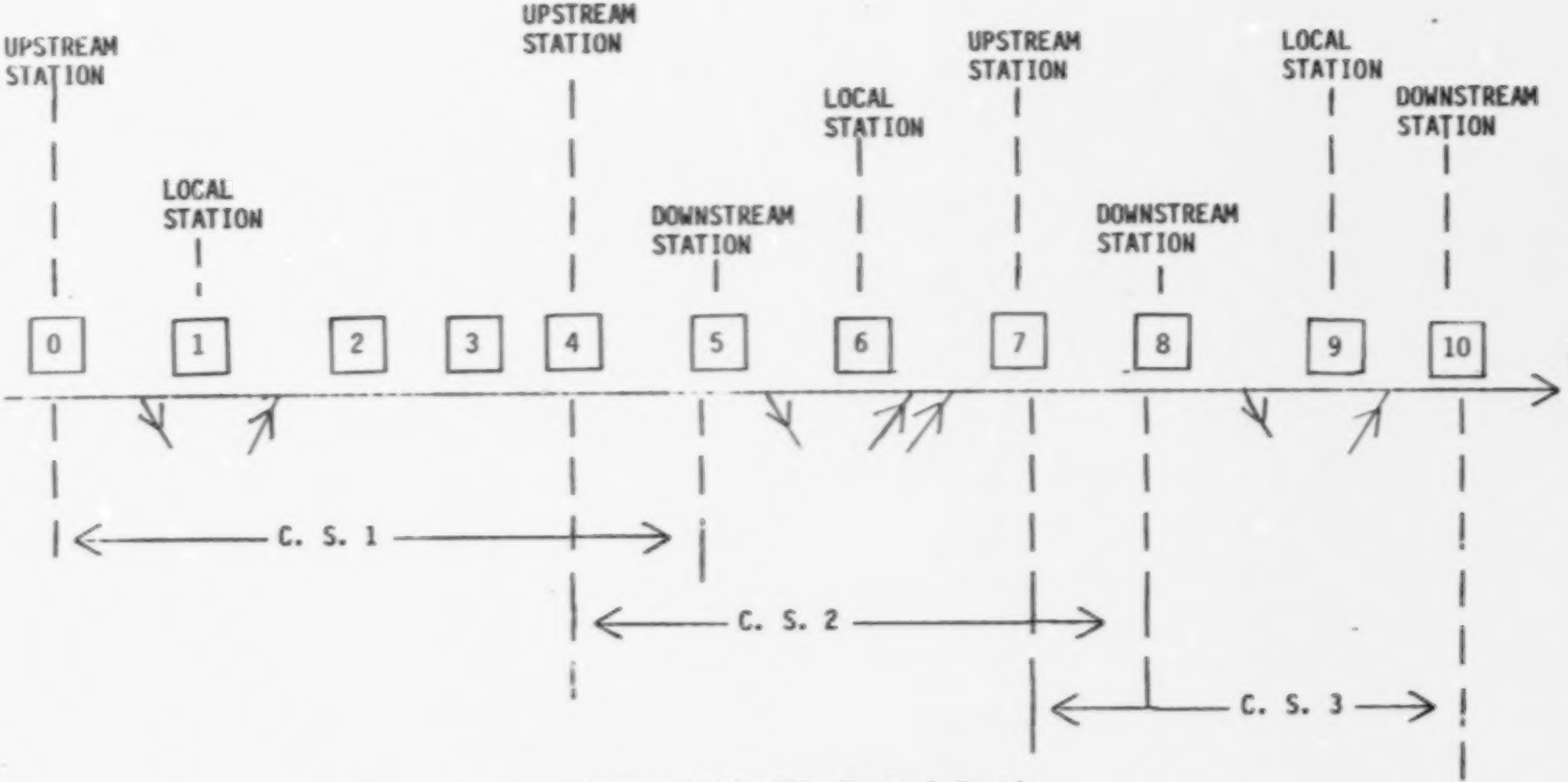


Figure 1/ Traffic Control Section

(Appendix 25)

	Occupancy Station		Volume Station	
Ramp Name	Local Station	Downstream Station	Upstream Station	Control Section 3
Southdown	1	5	0	4
Miss. SB	6	8	4	5
Miss. NB	6A	8	4	5
Hwy 10. SB	9	10	7	6
Hwy 10. NB	9	10	7	6

Index pointer to access real-time detector station data Table 'OCCTAB'

Index pointer to access ramp cycle length table 'CYCTAB'

Figure 2/ Ramp Characteristics Table "RAMTAB"

(Appendix 25)

	Occupancy threshold value		Volume threshold value		
Selected Cycle Length	Local Station Occupancy	Downstream Station Occupancy	Upstream Station C.S.1	Upstream Station C.S.2	Upstream Station C.S.3
1	10%	10%	47	58	60
2	13%	13%	55	67	65
3	16%	16%	63	72	73
4	23%	23%	73	77	81
5	30%	30%	82	80	87
6	60%	60%	85	84	91

Southdown Interchange

Miss. Interchange

HWY 10 Interchange

Note the the volume threshold value is in vehicles per station per minute.

Figure 3/ Ramp Cycle Length Selection Table "CYCTAB"

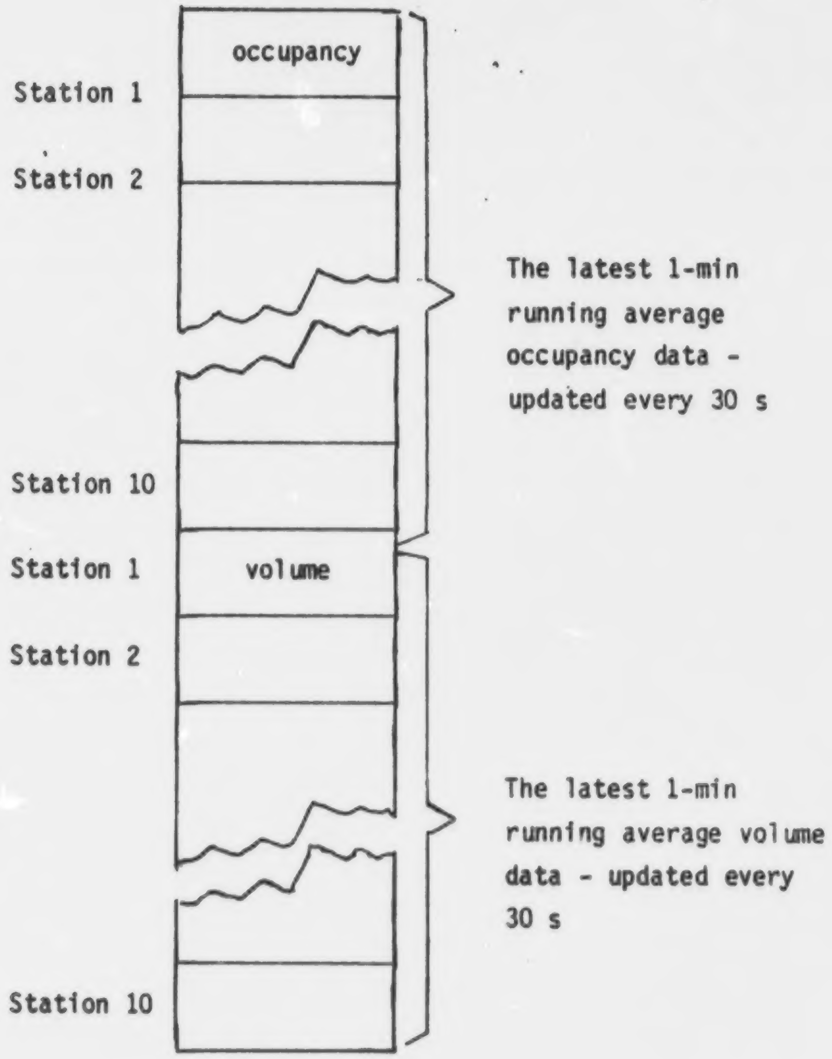

occupancy
Station 1
Station 2
Station 10
The latest 1-min running average occupancy data - updated every 30 s
volume
Station 1
Station 2
Station 10
The latest 1-min running average volume data - updated every 30 s

Figure 4/ Mainline Detector Station Data Table

(Appendix 25)

	Cycle Length (sec.)					
Ramp	Cycle 1	Cycle 2	Cycle 3	Cycle 4	Cycle 5	Cycle 6
Southdown	5.0	6.0	8.0	12.0	12.9	15.0
Miss. SB	5.5	6.9	9.0	12.9	13.9	14.4
Miss. NB	5.0	6.2	8.0	11.6	12.4	13.3
HWY 10. SB	4.5	5.7	7.2	8.0	9.0	11.6
HWY 10. NB	5.5	6.9	9.0	13.3	14.4	15.0

Figure 5/ Sample Metering Rate for CR710 Ramp Controller

Appendix 26/ Computerized Ramp Queue Detection Logic and Ramp Queue Override Feature

In a computerized freeway ramp control system, in order not to penalize the ramp users waiting excessively on the ramp, the ramp queue length detection and ramp queue override feature are a necessity.

1/ Ramp Queue Detector Location

Figures 1, 2 and 3 show the ramp queue detector location for three controlled QEW interchanges. Table 1 shows the estimated distance between each ramp queue detector and its corresponding demand detector.

2/ Ramp Queue Length Detection Logic

Obviously, to detect ramp queue length between the queue detector and the demand detector for a certain interval, e.g., every 30 s, it is only necessary to subtract the 30-s demand detector volume from the 30-s queue detector volume. The preceding procedure will generate the correct ramp queue length provided that the initial ramp queue length is equal to zero.

The detection of initial ramp queue length equal to zero can be accomplished by checking the start-up queue gap time for each queue detector before a ramp is turned on for metering.

Note that before a ramp is turned on for metering, the signal light is permanently green. Therefore, the vehicle does not have to stop on demand detector waiting for green signal. In other words, the traffic on the ramp is in free flow condition before morning rush hour metering period. Under this condition, the time interval required for a vehicle to travel from queue detector to the corresponding demand detector can be estimated or measured fairly accurately. This time interval will be called start-up queue gap time - Tg.

The logic to detect the initial ramp queue length equal to zero is then simply monitoring the queue detector in "OFF" state for at least the period of time which is equal to the corresponding start-up queue gap time - Tg. Table 1 shows each ramp's estimated start-up queue gap time based on the assumption that the average ramp speed is 30 km/h.

When the start-up queue gap time is detected, the computer will initialize the corresponding ramp queue length according to the succeeding volume count of the queue detector until the beginning of the next 30-second time slice period (assuming the traffic data is accumulated every 30 s.

From then on, the ramp queue length is simply equal to the sum of the preceding 30-s time slice ramp queue length plus the difference between the current 30-s queue detector volume and the current 30-s demand detector volume.

3/ Ramp Queue Override Feature

Table 1 also shows the estimated maximum allowable ramp queue length for each entrance ramp. When the ramp is turned on for metering, it is possible that the ramp queue length will approach the maximum allowable queue length due to excessive ramp demand. When this situation occurs, the traffic controller can override the computer selected metering rate by traffic control operator command language. It is estimated that with a 5 s cycle length, the maximum queue length can be cleared up within 6 min. Automatic ramp queue override feature can be incorporated in the future should it become necessary.

4/ Occupancy as Ramp Queue Length Detection Threshold

Since the 'occupancy' is an indication of the roadway congestion status, it is possible to use the queue detector occupancy as a threshold value to determine whether the maximum allowable ramp queue length has been reached or not. However, this can only be achieved after real field data has been collected and analyzed.

Table 1/ Queue Detector Characteristics Table

Appendix 26 (Continued)

Location	Q-detector	Distance	Maximum Queue Length	Start-up Queue Gap Time
HWY 10 (NB)	Q1	600'	24 veh.	20 s
HWY 10 (SB)	Q2	1 700'	68 veh.	55 s
MISS. (NB)	Q3	550'	22 veh.	18 s
MISS. (SB)	Q4	800'	32 veh.	26 s
MISS. (SB)	Q5	830'	33 veh.	28 s
SOUTHD. (NB)	Q6	1 250'	50 veh.	41 s
SOUTHD. (SB)	Q7	1 180'	47 veh.	39 s

(Appendix 26)

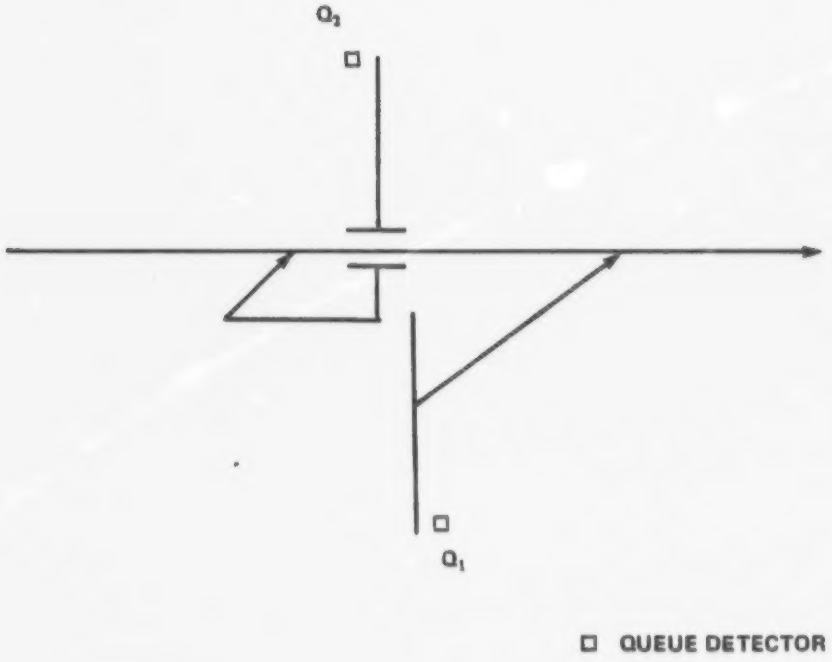


Figure 1/ Ramp Detector Locations at Highway 10

(Appendix 26)

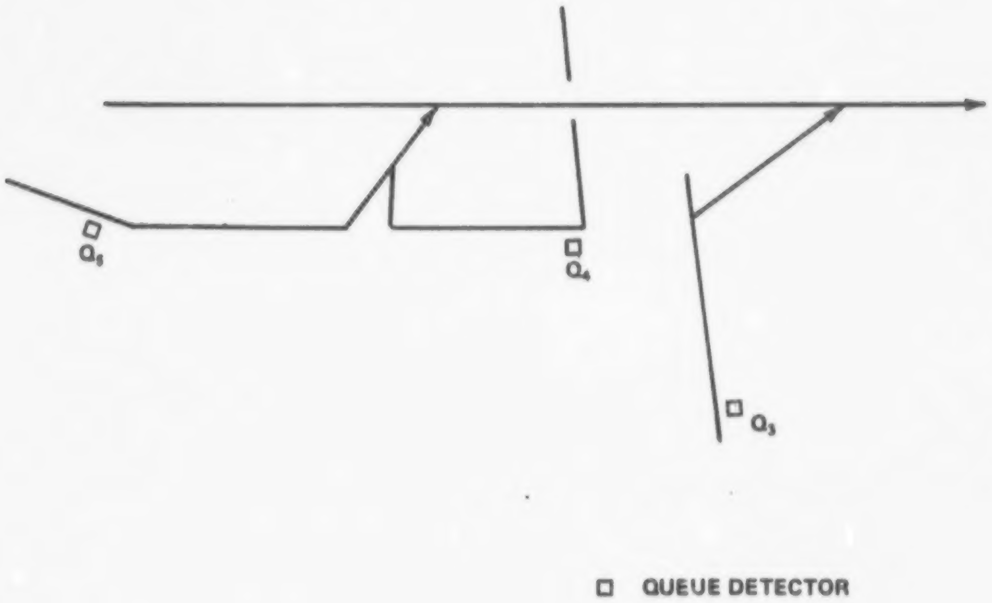


Figure 2/ Ramp Detector Locations at Mississauga Road

(Appendix 26)

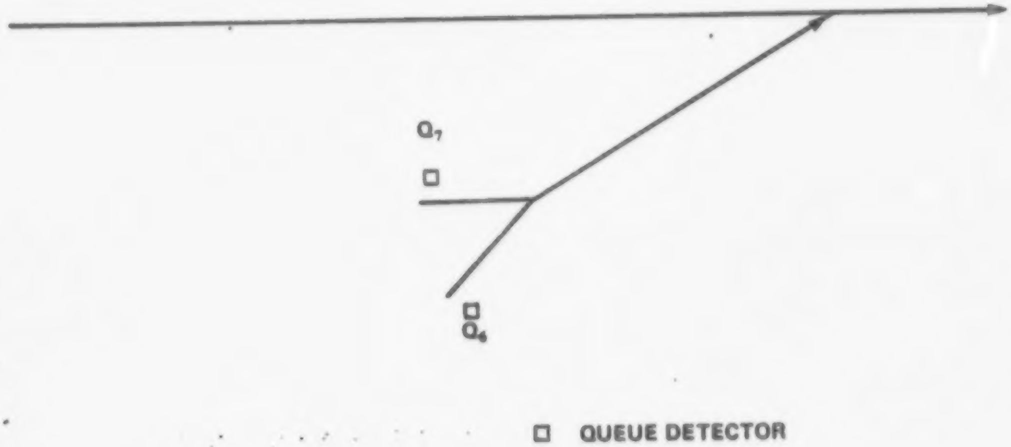


Figure 3/ Ramp Detector Locations at Southown Road

Appendix 27/ Data30 File Logical Record

Word#	Content	Station#	Lane#	Time Slice	Detector #
1	Hour				
2	minute			30-s interval	
3	second				
4	Control Period				
5	Reserved			Reserved for HOV	
6	Reserved				
7	Reserved				
8	Reserved				
9	MODCYC	Cawthra	NB ON	30-s	
10	Cycle Length	Cawthra	NB ON		
11	Queue Wait	Cawthra	NB ON		
12	Queue Length	Cawthra	NB ON		
13	MODCYC	Cawthra	SB ON		
14	Cycle Length	Cawthra	SB ON		
15	Queue Wait	Cawthra	SB ON		
16	Queue Length	Cawthra	SB ON		
17	MODCYC	Hwy 10	NB ON		
18	Cycle Length	Hwy 10	NB ON		
19	Queue Wait	Hwy 10	NB ON		
20	Queue Length	Hwy 10	NB ON		
21	MODCYC	Hwy 10	SB ON		
22	Cycle Length	Hwy 10	SB ON		
23	Queue Wait	Hwy 10	SB ON		
24	Queue Length	Hwy 10	SB ON		
25	MODCYC	Miss.	NB ON		
26	Cycle Length	Miss.	NB ON		
27	Queue Wait	Miss.	NB ON		
28	Queue Length	Miss.	NB ON		
29	MODCYC	Miss.	SB ON		
30	Cycle Length	Miss.	SB ON		
31	Queue Wait	Miss.	SB ON		
32	Queue Length	Miss.	SB ON		
33	MODCYC	Southdown	ON		
34	Cycle Length	Southdown	ON		
35	Queue Wait	Southdown	ON		
36	Queue Length	Southdown	ON		
37	MODCYC	Winston	NB ON		
38	Cycle Length	Winston	NB ON		
39	Queue Wait	Winston	NB ON		
40	Queue Length	Winston	NB ON	30-s	

Appendix 27 (Continued)

Word#	Content	Station#	Lane#	Time Slice	Detector #
41	MODCYC	Winston	SB ON	30-s	
42	Cycle Length	Winston	SB ON		
43	Queue Wait	Winston	SB ON		
44	Queue Length	Winston	SB ON		
45	MODCYC	Ford Dr.	ON		
46	Cycle Length	Ford Dr.	ON		
47	Queue Wait	Ford Dr.	ON		
48	Queue Length	Ford Dr.	ON		
49	PASSAGE VOLUME	Cawthra	NB		513
50		Cawthra	SB		516
51		Hwy 10	NB		1
52		Hwy 10	SB		3
53		Miss.	NB		28
54		Miss.	SB		31
55		Southdown	On Ramp		68
56		Winston	NB		91
57		Winston	SB		94
58		Ford Dr.	On Ramp		113
59	DEMAND VOLUME	Cawthra	NB		514
60		Cawthra	SB		517
61		Hwy 10	NB		2
62		Hwy 10	SB		4
63		Miss.	NB		29
64		Miss.	SB		32
65		Southdown	On Ramp		69
66		Winston	NB		92
67		Winston	SB		95
68		Ford Dr.	On Ramp		114
69	EXIT VOLUME	Cawthra	1		519
70		Cawthra	2		520
71		Hwy 10	Service		5
72		Hwy 10	NB		6
73		Hwy 10	SB		9
74		Miss.	Off Ramp		35
75		Southdown	Off Ramp		84
76		Winston	1		97
77		Winston	2		98
78		Ford Dr.	1		135
79		Ford Dr.	2		136
80	QUEUE VOLUME	Cawthra	NB		515
81		Cawthra	SB		518
82		Hwy 10	NB		7
83		Hwy 10	SB		8
84		Miss.	NB		30
85		Miss.	SBE		33
86		Miss.	SBW	30-s	34

Appendix 27 (Continued)

Word#	Content	Station#	Lane#	Time Slice	Detector #
87	QUEUE VOLUME	Southdown	S	30-s	70
88		Southdown	N		77
89		Winston	NB		93
90		Winston	SB		96
91		Ford Dr.	S		115
92		Ford Dr.	N		116
93	VOL	15A	Driving		36
94	VOL	15A	Centre		37
95	PASSAGE OCCUPANCY	Cawthra	NB		513
96		Cawthra	SB		516
97		Hwy 10	NB		1
98		Hwy 10	SB		3
99		Miss.	NB		28
100		Miss.	SB		31
101		Southdown	On Ramp		68
102		Winston	NB		91
103		Winston	SB		94
104		Ford Dr.	On Ramp		113
105	DEMAND OCCUPANCY	Cawthra	NB		514
106		Cawthra	SB		517
107		Hwy 10	NB		2
108		Hwy 10	SB		4
109		Miss.	NB		29
110		Miss.	SB		32
111		Southdown	On Ramp		69
112		Winston	NB		92
113		Winston	SB		95
114		Ford Dr.	On Ramp		114
115	EXIT OCCUPANCY	Cawthra	1		519
116		Cawthra	2		520
117		Hwy 10	Service		5
118		Hwy 10	NB		6
119		Hwy 10	SB		9
120		Miss.	Off Ramp		35
121		Southdown	Off Ramp		84
122		Winston	1		97
123		Winston	2		98
124		Ford Dr.	1		135
125		Ford Dr.	2		136
126	QUEUE OCCUPANCY	Cawthra	NB		515
127		Cawthra	SB		518
128		Hwy 10	NB		7
129		Hwy 10	SB		8
130		Miss.	NB		30
131		Miss.	SBE		33
132		Miss.	SBW		34
133		Southdown	S	30-s	70

Appendix 27 (Continued)

Word#	Content	Station#	Lane#	Time Slice	Detector #
134	↓ ↓	Southdown	N	30-s	77
135	↓ ↓	Winston	NB	↓	93
136	↓ ↓	Winston	SB	↓	96
137	↓ ↓	Ford Dr.	S	↓	115
138	↓ ↓	Ford Dr.	N	↓	116
139	OCC	15A	Driving	↓	36
140	OCC	15A	Centre	↓	37
141	DOWNSTREAM VOLUME	22	Driv (1)	↓	528
142	↓ ↓	22	Cntr (2)	↓	530
143	↓ ↓	22	Pass (3)	↓	532
144	↓ ↓	21	1	↓	522
145	↓ ↓	21	2	↓	524
146	↓ ↓	21	3	↓	526
147	↓ ↓	20	1	↓	508
148	↓ ↓	20	2	↓	510
149	↓ ↓	20	3	↓	512
150	↓ ↓	19	1	↓	502
151	↓ ↓	19	2	↓	504
152	↓ ↓	19	3	↓	506
153	↓ ↓	18	1	↓	11
154	↓ ↓	18	2	↓	13
155	↓ ↓	18	3	↓	15
156	↓ ↓	17	1	↓	17
157	↓ ↓	17	2	↓	19
158	↓ ↓	17	3	↓	21
159	↓ ↓	16	1	↓	23
160	↓ ↓	16	2	↓	25
161	↓ ↓	16	3	↓	27
162	↓ ↓	15	Driv (1)	↓	39
163	↓ ↓	15	Cntr (2)	↓	41
164	↓ ↓	15	Pass (3)	↓	43
165	↓ ↓	14	Driv (1)	↓	45
166	↓ ↓	14	Cntr (2)	↓	47
167	↓ ↓	14	Pass (3)	↓	49
168	↓ ↓	13	Driv (1)	↓	51
169	↓ ↓	13	Cntr (2)	↓	53
170	↓ ↓	13	Pass (3)	↓	55
171	↓ ↓	12	1	↓	57
172	↓ ↓	12	2	↓	59
173	↓ ↓	12	3	↓	61
174	↓ ↓	11	1	↓	63
175	↓ ↓	11	2	↓	65
176	↓ ↓	11	3	↓	67
177	↓ ↓	10	1	↓	72
178	↓ ↓	10	2	↓	74
179	↓ ↓	10	3	↓	76
180	↓ ↓	9	1	↓	79
181	↓ ↓	9	2	↓	81
182	↓ ↓	9	3	↓	83
183		8	1	30-s	86

Appendix 27 (Continued)

Word#	Content	Station#	Lane#	Time Slice	Detector #
184	DOWNSTREAM VOLUME	8	2	30-s	88
185		8	3		90
186		7	1		100
187		7	2		102
188		7	3		104
189		6	Driving		106
190		6	R. Centre		108
191		6	L. Centre		110
192		6	Passing		112
193		5	1		118
194		5	2		120
195		5	3		122
196		4	Driv (1)		124
197		4	Cntr (1)		126
198		4	Pass (3)		128
199		3	Driv (1)		130
200		3	Cntr (2)		132
201		3	Pass (3)		134
202		2	1		138
203		2	2		140
204		2	3		142
205		1	Driv (1)		144
206		1	Cntr (2)		146
207		1	Pass (3)	30-s	148
208	UPSTREAM VOLUME	22	Driv (1)	30-s	527
209		22	Cntr (2)		529
210		22	Pass (3)		531
211		21	1		521
212		21	2		523
213		21	3		525
214		20	1		507
215		20	2		509
216		20	3		511
217		19	1		501
218		19	2		503
219		19	3		505
220		18	1		10
221		18	2		12
222		18	3		14
223		17	1		16
224		17	2		18
225		17	3		20
226		16	1		22
227		16	2		24
228		16	3		26
229		15	Driv (1)		38
230		15	Cntr (2)		40
231		15	Pass (3)		42
232		14	Driv (1)		44
233		14	Cntr (2)		46
234		14	Pass (3)		48
235		13	1	30 s	50

Appendix 27 (Continued)

Word#	Content	Station#	Lane#	Time Slice	Detector #
236	UPSTREAM VOLUME	13	2	30-s	52
237		13	3		54
238		12	1		56
239		12	2		58
240		12	3		60
241		11	1		62
242		11	2		64
243		11	3		66
244		10	1		71
245		10	2		73
246		10	3		75
247		9	1		78
248		9	2		80
249		9	3		82
250		8	1		85
251		8	2		87
252		8	3		89
253		7	1		99
254		7	2		101
255		7	3		103
256		6	Driving		105
257		6	R. Centre		107
258		6	L. Centre		109
259		6	Passing		111
260		5	1		117
261		5	2		119
262		5	3		121
263		4	1		123
264		4	2		125
265		4	3		127
266		3	1		129
267		3	2		131
268		3	3		133
269		2	1		137
270		2	2		139
271		2	3		141
272		1	Driv (1)		143
273		1	Cntr (2)		145
274		1	Pass (3)	30-s	147
275	DOWNSTREAM OCCUPANCY	22	Driv (1)	30-s	528
276		22	Cntr (2)		530
277		22	Pass (3)		532
278		21	1		522
279		21	2		524
280		21	3		526
281		20	1		508
282		20	2		510
283		20	3	30-s	512

Appendix 27 (Continued)

Word#	Content	Station#	Lane#	Time Slice	Detector #
284	DOWNSTREAM OCCUPANCY	19	1	30-s	502
285		19	2		504
286		19	3		506
287		18	1		11
288		18	2		13
289		18	3		15
290		17	1		17
291		17	2		19
292		17	3		21
293		16	1		23
294		16	2		25
295		16	3		27
296		15	Driv (1)		39
297		15	Cntr (2)		41
298		15	Pass (3)		43
299		14	Driv (1)		45
300		14	Cntr (2)		47
301		14	Pass (3)		49
302		13	1		51
303		13	2		53
304		13	3		55
305		12	1		57
306		12	2		59
307		12	3		61
308		11	1		63
309		11	2		65
310		11	3		67
311		10	1		72
312		10	2		74
313		10	3		76
314		9	1		79
315		9	2		81
316		9	3		83
317		8	1		86
318		8	2		88
319		8	3		90
320		7	1		100
321		7	2		102
322		7	3		104
323		6	Driving		106
324		6	R. Centre		108
325		6	L. Centre		110
326		6	Passing		112
327		5	1		118
328		5	2		120
329		5	3	30-s	122

Appendix 27 (Continued)

Word#	Content	Station#	Lane#	Time Slice	Detector #
330	DOWNSTREAM OCCUPANCY	4	1	30-s	124
331		4	2		126
332		4	3		128
333		3	1		130
334		3	2		132
335		3	3		134
336		2	1		138
337		2	2		140
338		2	3		142
339		1	Driv (1)		144
340		1	Cntr (2)		146
341		1	Pass (3)	30-s	148
342	UPSTREAM OCCUPANCY	22	Driv (1)	30-s	527
343		22	Cntr (2)		529
344		22	Pass (3)		531
345		21	1		521
346		21	2		523
347		21	3		525
348		20	1		507
349		20	2		509
350		20	3		511
351		19	1		501
352		19	2		503
353		19	3		505
354		18	1		10
355		18	2		12
356		18	3		14
357		17	1		16
358		17	2		18
359		17	3		20
360		16	Driv (1)		22
361		16	Cntr (2)		24
362		16	Pass (3)		26
363		15	Driv (1)		38
364		15	Cntr (2)		40
365		15	Pass (3)		42
366		14	1		44
367		14	2		46
368		14	3		48
369		13	1		50
370		13	2		52
371		13	3		54
372		12	1		56
373		12	2		58
374		12	3		60
375		11	1		62
376		11	2		64
377		11	3	30-s	66

Appendix 27 (Continued)

Word#	Content	Station#	Lane#	Time Slice	Detector #
378	UPSTREAM OCCUPANCY	10	1	30-s	71
379		10	2		73
380		10	3		75
381		9	1		78
382		9	2		80
383		9	3		82
384		8	1		85
385		8	2		87
386		8	3		89
387		7	1		99
388		7	2		101
389		7	3		103
390		6	Driving		105
391		6	R. Center		107
392		6	L. Centre		109
393		6	Passing		111
394		5	Driv (1)		117
395		5	Cntr (2)		119
396		5	Pass (3)		121
397		4	Driv (1)		123
398		4	Cntr (2)		125
399		4	Pass (3)		127
400		3	1		129
401		3	2		131
402		3	3		133
403		2	1		137
404		2	2		139
405		2	3		141
406		1	Driv (1)		143
407		1	Cntr (2)		145
408		1	Pass (3)	30-s	147
409	SPEED (M/S)	22	Driv (1)	30-s	
410		22	Cntr (2)		
411		22	Pass (3)		
412		21	1		
413		21	2		
414		21	3		
415		20	1		
416		20	2		
417		20	3		
418		19	1		
419		19	2		
420		19	3		
421		18	1		
422		18	2		
423	SPEED (M/S)	18	3	30-s	

Appendix 27 (Continued)

Word#	Content	Station#	Lane#	Time Slice	Detector #
424	SPEED (M/S)	17	1	30-s	
425		17	2		
426		17	3		
427		16	Driv		
428		16	Cntr		
429		16	Pass		
430		15	Driv (1)		
431		15	Cntr (2)		
432		15	Pass (3)		
433		14	1		
434		14	2		
435		14	3		
436		13	1		
437		13	2		
438		13	3		
439		12	1		
440		12	2		
441		12	3		
442		11	1		
443		11	1		
444		11	3		
445		10	1		
446		10	2		
447		10	3		
448		9	1		
449		9	2		
450		9	3		
451		8	1		
452		8	2		
453		8	3		
454		7	1		
455		7	2		
456		7	3		
457		6	Driving		
458		6	R. Centre		
459		6	L. Centre		
460		6	Passing		
461		5	Driv		
462		5	Cntr		
463		5	Pass		
464		4	1		
465		4	2		
466		4	3		
467		3	1		
468		3	2		
469	SPEED (M/S)	3	3	30-s	

Appendix 27 (Continued)

Word#	Content	Station#	Lane#	Time Slice	Detector #
470	SPEED (M/S)	2	1	30-s	
471		2	2		
472		2	3		
473		1	Driv (1)		
474		1	Cntr (2)		
475		1	Pass (3)	30-s	
476	LONG VEHICLE COUNT	22	Driv (1)	30-s	
477		22	Cntr (2)		
478		22	Pass (3)		
479		21	1		
480		21	2		
481		21	3		
482		20	1		
483		20	2		
484		20	3		
485		19	1		
486		19	2		
487		19	3		
488		18	1		
489		18	2		
490		18	3		
491		17	1		
492		17	2		
493		17	3		
494		16	Driv (1)		
495		16	Cntr (2)		
496		16	Pass (3)		
497		15	1		
498		15	2		
499		15	3		
500		14	1		
501		14	2		
502		14	3		
503		13	1		
504		13	2		
505		13	3		
506		12	1		
507		12	2		
508		12	3		
509		11	1		
510		11	2		
511		11	3		
512		10	1		
513		10	2		
514		10	3		
515		9	1		
516		9	2		
517		9	3	30-s	

Appendix 27 (Continued)

Word#	Content	Station#	Lane#	Time Slice	Detector #
518	LONG VEHICLE COUNT	8	1	30-s	
519		8	2		
520		8	3		
521		7	1		
522		7	2		
523		7	3		
524		6	Driving (1)		
525		6	R. Center		
526		6	L. Center		
527		6	Passing (3)		
528		5	Driv (1)		
529		5	Cntr (2)		
530		5	Pass (3)		
531		4	1		
532		4	2		
533		4	3		
534		3	1		
535		3	2		
536		3	3		
537		2	1		
538		2	2		
539		2	3		
540		1	Driv (1)		
541		1	Cntr (2)		
542		1	Pass (3)	30-s	
543	STATION OCCUPANCY	1		30-s	
544		2			
545		3			
546		4			
547		5			
548		6			
549		7			
550		8			
551		9			
552		10			
553		11			
554		12			
555		13			
556		14			
557		15			
558		16			
559		17			
560		18			
561		19			
562		20			
563		21			
564		22		30-s	

Appendix 27 (Continued)

Word#	Content	Station#	Lane#	Time Slice	Detector #
565	STATION OCCUPANCY	1		PRECEDING	30-s
566	↓	2		↓	↓
567	↓	3		↓	↓
568	↓	4		↓	↓
569	↓	5		↓	↓
570	↓	6		↓	↓
571	↓	7		↓	↓
572	↓	8		↓	↓
573	↓	9		↓	↓
574	↓	10		↓	↓
575	↓	11		↓	↓
576	↓	12		↓	↓
577	↓	13		↓	↓
578	↓	14		↓	↓
579	↓	15		↓	↓
580	↓	16		↓	↓
581	↓	17		↓	↓
582	↓	18		↓	↓
583	↓	19		↓	↓
584	↓	20		↓	↓
585	↓	21		↓	↓
586	↓	22		PRECEDING	30-s
587	STATION OCCUPANCY	1		1 Min	
588	↓	2		↓	
589	↓	3		↓	
590	↓	4		↓	
591	↓	5		↓	
592	↓	6		↓	
593	↓	7		↓	
594	↓	8		↓	
595	↓	9		↓	
596	↓	10		↓	
597	↓	11		↓	
598	↓	12		↓	
599	↓	13		↓	
600	↓	14		↓	
601	↓	15		↓	
602	↓	16		↓	
603	↓	17		↓	
604	↓	18		↓	
605	↓	19		↓	
606	↓	20		↓	
607	↓	21		↓	
608		22		↓	
609	STATION VOLUME	1		↓	
610	↓	2		↓	
611	↓	3		↓	
612	↓	4		1 Min	

Appendix 27 (Continued)

Word#	Content	Station#	Lane#	Time Slice	Detector #
613	STATION VOLUME	5		1 Min	
614		6			
615		7			
616		8			
617		9			
618		10			
619		11			
620		12			
621		13			
622		14			
623		15			
624		16			
625		17			
626		18			
627		19			
628		20			
629		21			
630	↓	22		1 Min	
631	STATION VOLUME	1		30 s	
632		2			
633		3			
634		4			
635		5			
636		6			
637		7			
638		8			
639		9			
640		10			
641		11			
642		12			
643		13			
644		14			
645		15			
646		16			
647		17			
648		18			
649		19			
650		20			
651		21			
652	↓	22		30 s	
653	STATION VOLUME	1		PRECEDING	30-s
654		2			
655		3			
656		4			
657		5			
658		6			
659		7			
660	↓	8		PRECEDING	30-s

Appendix 27 (Continued)

Word#	Content	Station#	Lane#	Time Slice	Detector #
661	STATION VOLUME	9		PRECEDING	30-s
662	↓ ↓	10		↓	↓
663	↓ ↓	11		↓	↓
664	↓ ↓	12		↓	↓
665	↓ ↓	13		↓	↓
666	↓ ↓	14		↓	↓
667	↓ ↓	15		↓	↓
668	↓ ↓	16		↓	↓
669	↓ ↓	17		↓	↓
670	↓ ↓	18		↓	↓
671	↓ ↓	19		↓	↓
672	↓ ↓	20		↓	↓
673	↓ ↓	21		↓	↓
674	↓ ↓	22		PRECEDING	30-s
675	STATION SPEED	1		30-s	
676	↓ ↓	2		↓	
677	↓ ↓	3		↓	
678	↓ ↓	4		↓	
679	↓ ↓	5		↓	
680	↓ ↓	6		↓	
681	↓ ↓	7		↓	
682	↓ ↓	8		↓	
683	↓ ↓	9		↓	
684	↓ ↓	10		↓	
685	↓ ↓	11		↓	
686	↓ ↓	12		↓	
687	↓ ↓	13		↓	
688	↓ ↓	14		↓	
689	↓ ↓	15		↓	
690	↓ ↓	16		↓	
691	↓ ↓	17		↓	
692	↓ ↓	18		↓	
693	↓ ↓	19		↓	
694	↓ ↓	20		↓	
695	↓ ↓	21		↓	
696	↓ ↓	22		30-s	
697	LANE STATUS	1	ALL		
698	↓ ↓	2	↓		
699	↓ ↓	3	↓		
700	↓ ↓	4	↓		
701	↓ ↓	5	↓		
702	↓ ↓	6	↓		
703	↓ ↓	7	↓		
704	↓ ↓	8	↓		
705	↓ ↓	9	↓		
706	↓ ↓	10	↓		
707		11	ALL		

Appendix 27 (Continued)

Word#	Content		Station#	Lane#	Time Slice	Detector #
708	LANE	STATUS	12	ALL		
709	↓	↓	13	↓		
710	↓	↓	14	↓		
711	↓	↓	15	↓		
712	↓	↓	16	↓		
713	↓	↓	17	↓		
714	↓	↓	18	↓		
715	↓	↓	19	↓		
716	↓	↓	20	↓		
717	↓	↓	21	↓		
718	↓	↓	22	ALL		

Appendix 28/ Data-5M File Logical Record

Word#	Content	Station#	Lane#	Time Slice	Detector#
1	Hour				
2	Minute			5 Min.	
3	second				
4	PASSAGE VOLUME	Cawthra	NB	5 Min.	513
5		Cawthra	SB		516
6		Hwy 10	NB		1
7		Hwy 10	SB		3
8		Miss.	NB		28
9		Miss.	SB		31
10		Southdown	On Ramp		68
11		Winston	NB		91
12		Winston	SB		94
13		Ford Dr.	On Ramp		113
14	DEMAND VOLUME	Cawthra	NB		514
15		Cawthra	SB		517
16		Hwy 10	NB		2
17		Hwy 10	SB		4
18		Miss.	NB		29
19		Miss.	SB		32
20		Southdown	On Ramp		69
21		Winston	NB		92
22		Winston	SB		95
23		Ford Dr.	On Ramp		114
24	EXIT VOLUME	Cawthra	1		519
25		Cawthra	2		520
26		Hwy 10	Service		5
27		Hwy 10	NB		6
28		Hwy 10	SB		9
29		Miss.	Off Ramp		35
30		Southdown	Off Ramp		84
31		Winston	1		97
32		Winston	2		98
33		Ford Dr.	1		135
34		Ford Dr.	2		136
35	QUEUE VOLUME	Cawthra	NB		515
36		Cawthra	SB		518
37		Hwy 10	NB		7
38		Hwy 10	SB		8
39		Miss.	NB		30
40		Miss.	SB E		33
41		Miss.	SB W		34
42		Southdown	S		70
43		Southdown	N		77
44		Winston	NB		93
45		Winston	SB		96
46		Ford Dr.	S		115
47		Ford Dr.	N	5 Min.	116

Appendix 28 (Continued)

Word#	Content	Station#	Lane#	Time Slice	Detector#
48	VOL	15A	Driv	5 Min.	36
49	VOL	15A	Pass		37
50	PASSAGE OCCUPANCY	Cawthra	NB		513
51		Cawthra	SB		516
52		Hwy 10	NB		1
53		Hwy 10	SB		3
54		Miss.	NB		28
55		Miss.	SB		31
56		Southdown	On Ramp		68
57		Winston	NB		91
58		Winston	SB		94
59		Ford Dr.	On Ramp		113
60	DEMAND OCCUPANCY	Cawthra	NB		514
61		Cawthra	SB		517
62		Hwy 10	NB		2
63		Hwy 10	SB		4
64		Miss.	NB		29
65		Miss.	SB		32
66		Southdown	On Ramp		69
67		Winston	NB		92
68		Winston	SB		95
69		Ford Dr.	On Ramp		114
70	EXIT OCCUPANCY	Cawthra	1		519
71		Cawthra	2		520
72		Hwy 10	Service		5
73		Hwy 10	NB		6
74		Hwy 10	SB		9
75		Miss.	Off Ramp		35
76		Southdown	Off Ramp		89
77		Winston	1		97
78		Winston	2		98
79		Ford Dr.	1		135
80		Ford Dr.	2		136
81	QUEUE OCCUPANCY	Cawthra	NB		515
82		Cawthra	SB		518
83		Hwy 10	NB		7
84		Hwy 10	SB		8
85		Miss.	NB		30
86		Miss.	SB E		33
87		Miss.	SB W		34
88		Southdown	S		70
89		Southdown	N		77
90		Winston	NB		93
91		Winston	SB		96
92		Ford Dr.	S		115
93		Ford Dr.	N	5 Min.	116

Appendix 28 (Continued)

Word#	Content	Station#	Lane#	Time Slice	Detector#
94	OCC.	15A	Driv	5 Min.	36
95	OCC.	15A	Pass		37
96	VOLUME	22	Driv		528
97		22	Cntr		530
98		21	Pass		532
99		21	Driv		522
100		21	Cntr		524
101		21	Pass		526
102	DOWNSTREAM VOLUME	20	Driv		508
103		20	Cntr		510
104		20	Pass		512
105		19	Driv		502
106		19	Cntr		504
107		19	Pass		506
108		18	Driv		11
109		18	Cntr		13
110		18	Pass		15
111		17	Driv		17
112		17	Cntr		19
113		17	Pass		21
114		16	Driv		23
115		16	Cntr		25
116		16	Pass		27
117		15	Driv		39
118		15	Cntr		41
119		15	Pass		43
120		14	Driv		45
121		14	Cntr		47
122		14	Pass		49
123		13	Driv		51
124		13	Cntr		53
125		13	Pass		55
126		12	Driv		57
127		12	Cntr		59
128		12	Pass		61
129	VOLUME	11	Driv		63
130		11	Cntr		65
131		11	Pass		67
132		10	Driv		72
133		10	Cntr		74
134	VOLUME	10	Pass		76
135	DOWNSTREAM VOLUME	9	Driv		79
136		9	Cntr		81
137		9	Pass		83
138		8	Driv		86
139		8	Cntr		88
140		8	Pass	5 Min.	90

Appendix 28 (Continued)

Word#	Content	Station#	Lane#	Time Slice	Detector#
141	DOWNSTREAM VOLUME	7	Driv	5 Min.	100
142		7	Cntr		102
143		7	Pass		104
144		6	Driv		106
145		6	R. Centre		108
146		6	L. Centre		110
147		6	Pass		112
148		5	Driv		118
149		5	Cntr		120
150		5	Pass		122
151		4	Driv		124
152		4	Cntr		126
153		4	Pass		128
154		3	Driv		130
155		3	Cntr		132
156		3	Pass		134
157		2	Driv		138
158		2	Cntr		140
159		2	Pass		142
160		1	Driv		144
161		1	Cntr		146
162		1	Pass		148
163	UPSTREAM VOLUME	22	Driv		527
164		22	Cntr		529
165		22	Pass		531
166		21	Driv (1)		521
167		21	Cntr (2)		523
168		21	Pass (3)		525
169		20	Driv (1)		507
170		20	Cntr (2)		509
171		20	Pass (3)		511
172		19	Driv (1)		501
173		19	Cntr (2)		503
174		19	Pass (3)		505
175		18	Driv (1)		10
176		18	Cntr (2)		12
177		18	Pass (3)		14
178		17	Driv (1)		16
179		17	Cntr (2)		18
180		17	Pass (3)		20
181		16	Driv (1)		22
182		16	Cntr (2)		24
183		16	Pass (3)		26
184		15	Driv (1)		38
185		15	Cntr (2)		40
186		15	Pass (3)	5 Min.	42

Appendix 28 (Continued)

Word#	Content	Station#	Lane#	Time Slice	Detector#
187	UPSTREAM VOLUME	14	Driv (1)	5 Min.	44
188		14	Cntr (2)		46
189		14	Pass (3)		48
190		13	Driv (1)		50
191		13	Cntr (2)		52
192		13	Pass (3)		54
193		12	Driv (1)		56
194		12	Cntr (2)		58
195		12	Pass (3)		60
196		11	Driv (1)		62
197		11	Cntr (2)		64
198		11	Pass (3)		66
199		10	Driv (1)		71
200		10	Cntr (2)		73
201		10	Pass (3)		75
202		9	1		78
203		9	2		80
204		9	3		82
205		8	1		85
206		8	2		87
207		8	3		89
208		7	1		99
209		7	2		101
210		7	3		103
211		6	Driv		105
212		6	R. Centre		107
213		6	L. Centre		109
214		6	Pass		111
215		5	1		117
216		5	2		119
217		5	3		121
218		4	1		123
219		4	2		125
220		4	3		127
221		3	1		129
222		3	2		131
223		3	3		133
224		2	1		137
225		2	2		139
226		2	3		141
227		1	1		143
228		1	2		145
229		1	3		147
230	DOWNSTREAM OCCUPANCY	22	Driv (1)		528
231		22	Cntr (2)		530
232		22	Pass (3)	5 Min.	532

Appendix 28 (Continued)

Word#	Content	Station#	Lane#	Time Slice	Detector#
233	DOWNSTREAM OCCUPANCY	21	1	5 Min.	522
234		21	2		524
235		21	3		526
236		20	1		508
237		20	2		510
238		20	3		512
239		19	1		502
240		19	2		504
241		19	3		506
242		18	1		11
243		18	2		13
244		18	3		15
245		17	1		17
246		17	2		19
247		17	3		21
248		16	1		23
249		16	2		25
250		16	3		27
251		15	1		39
252		15	2		41
253		15	3		43
254		14	1		45
255		14	2		47
256		14	3		49
257		13	1		51
258		13	2		53
259		13	3		55
260		12	1		57
261		12	2		59
262		12	3		61
263		11	1		63
264		11	2		65
265		11	Pass (3)		67
266		10	Driv (1)		72
267		10	Cntr (2)		74
268		10	Pass (3)		76
269		9	1		79
270		9	2		81
271		9	3		83
272		8	1		86
273		8	2		88
274		8	3		90
275		7	1		100
276		7	2		102
277		7	3	5 Min.	104

Appendix 28 (Continued)

Word#	Content	Station#	Lane#	Time Slice	Detector#
278	DOWNSTREAM OCCUPANCY	6	Driv	5 Min.	106
279		6	R. Centre		108
280		6	L. Centre		110
281		6	Pass		112
282		5	1		118
283		5	2		120
284		5	3		122
285		4	1		124
286		4	2		126
287		4	3		128
288		3	1		130
289		3	2		132
290		3	3		134
291		2	1		138
292		2	2		140
293		2	3		142
294		1	Driv (1)		144
295		1	Cntr (2)		146
296		1	Pass (3)		148
297	UPSTREAM OCCUPANCY	22	Driv (1)		527
298		22	Cntr (2)		529
299		22	Pass (3)		531
300		21	Driv (1)		521
301		21	Cntr (2)		523
302		21	Pass (3)		525
303		20	1		507
304		20	2		509
305		20	3		511
306		19	1		501
307		19	2		503
308		19	3		505
309		18	1		10
310		18	2		12
311		18	3		14
312		17	1		16
313		17	2		18
314		17	3		20
315		16	1		22
316		16	2		24
317		16	3		26
318		15	1		38
319		15	2		40
320		15	3		42
321		14	1		44
322		14	2		46
323		14	3	5 Min.	48

Appendix 28 (Continued)

Word#	Content	Station#	Lane#	Time Slice	Detector#
324	UPSTREAM OCCUPANCY	13	1	5 Min.	50
325		13	2		52
326		13	3		54
327		12	Driv (1)		56
328		12	Cntr (2)		58
329		12	Pass (3)		60
330		11	Driv (1)		62
331		11	Cntr (2)		64
332		11	Pass (3)		66
333		10	Driv (1)		71
334		10	Cntr (2)		73
335		10	Pass (3)		75
336		9	1		78
337		9	2		80
338		9	3		82
339		8	1		85
340		8	2		87
341		8	3		89
342		7	1		99
343		7	2		101
344		7	3		103
345		6	Driv		105
346		6	R. Centre		107
347		6	L. Centre		109
348		6	Pass		111
349		5	1		117
350		5	2		119
351		5	3		121
352		4	1		123
353		4	2		125
354		4	3		127
355		3	1		129
356		3	2		131
357		3	3		133
358		2	1		137
359		2	2		139
360		2	3		141
361		1	Driv (1)		143
362		1	Cntr (2)		145
363		1	Pass (3)		147
364	LONG VEHICLE COUNT	22	Driv (1)		
365		22	Cntr (2)		
366		22	Pass (3)		
367		21	1		
368		21	2		
369		21	3	5-Min.	

Appendix 28 (Continued)

Word#	Content	Station#	Lane#	Time Slice	Detector#
370	LONG VEHICLE COUNT	20	1	5 Min.	
371		20	2		
372		20	3		
373		19	1		
374		19	2		
375		19	3		
376		18	1		
377		18	2		
378		18	3		
379		17	1		
380		17	2		
381		17	3		
382		16	1		
383		16	2		
384		16	3		
385		15	1		
386		15	2		
387		15	3		
388		14	1		
389		14	2		
390		14	3		
391		13	1		
392		13	2		
393		13	3		
394		12	1		
395		12	2		
396		12	3		
397		11	Driv (1)		
398		11	Cntr (2)		
399		11	Pass (3)		
400		10	1		
401		10	2		
402		10	3		
403		9	1		
404		9	2		
405		9	3		
406		8	1		
407		8	2		
408		8	3		
409		7	1		
410		7	2		
411		7	3		
412		6	Driv		
413		6	R. Centre		
414		6	L. Centre		
415		6	Pass	5 Min.	

Appendix 28 (Continued)

Word#	Content	Station#	Lane#	Time Slice	Detector#
416	LONG VEHICLE COUNT	5	1	5 Min.	
417		5	2		
418		5	3		
419		4	1		
420		4	2		
421		4	3		
422		3	1		
423		3	2		
424		3	3		
425		2	1		
426		2	2		
427		2	3		
428		1	Driv (1)		
429		1	Cntr (2)		
430		1	Pass (3)	5 Min.	

Appendix 29/ QEWDYN File Logical Record

Word#	Content	Station#	Lane#	Time Slice	Detector#
1	Year				
2	Month			1 Min.	
3	Day			Interval	
4	Hour				
5	minute				
6	second				
7	MODCYC	Cawthra	NB	Latest 30 s	
8	Cycle Length	Cawthra	NB		
9	Queue Wait	Cawthra	NB		
10	Queue Occupancy	Cawthra	NB	Smoothed 30 s	
11	Reserved	Cawthra	NB		
12	MODCYC	Cawthra	SB	Latest 30 s	
13	Cycle Length	Cawthra	SB		
14	Queue Wait	Cawthra	SB		
15	Queue Occupancy	Cawthra	SB	Smoothed 30 s	
16	Reserved	Cawthra	SB		
17	MODCYC	Hwy 10	NB	Latest 30 s	
18	Cycle Length	Hwy 10	NB		
19	Queue Wait	Hwy 10	NB		
20	Queue Occupancy	Hwy 10	NB	Smoothed 30 s	
21	Reserved	Hwy 10	NB		
22	MODCYC	Hwy 10	SB	Latest 30 s	
23	Cycle Length	Hwy 10	SB		
24	Queue Wait	Hwy 10	SB		
25	Queue Occupancy	Hwy 10	SB	Smoothed 30 s	
26	Reserved	Hwy 10	SB		
27	MODCYC	Miss.	NB	Latest 30 s	
28	Cycle Length	Miss.	NB		
29	Queue Wait	Miss.	NB		
30	Queue Occupancy	Miss.	NB	Smoothed 30 s	
31	Reserved	Miss.	NB		
32	MODCYC	Miss.	SB	Latest 30 s	
33	Cycle Length	Miss.	SB		
34	Queue Wait	Miss.	SB		
35	Queue Occupancy	Miss.	SB	Smoothed 30 s	
36	Reserved	Miss.	SB		
37	MODCYC	Southdown	--	Latest 30 s	
38	Cycle Length	Southdown	--		
39	Queue Wait	Southdown	--		
40	Queue Occupancy	Southdown	--	Smoothed 30 s	
41	Reserved	Southdown	--		
42	MODCYC	Winston	NB	Latest 30 s	
43	Cycle Length	Winston	NB		
44	Queue Wait	Winston	NB		
45	Queue Occupancy	Winston	NB	Smoothed 30 s	
46	Reserved	Winston	NB		

Appendix 29 (Continued)

Word#	Content	Station#	Lane#	Time Slice	Detector#
47	MODCYC	Winston	SB	Latest 30 s	
48	Cycle Length	Winston	SB	↓	
49	Queue Wait	Winston	SB	↓	
50	Queue Occupancy	Winston	SB	Smoothed 30 s	
51	Reserved	Winston	SB		
52	MODCYC	Ford Dr.	--	Latest 30 s	
53	Cycle Length	Ford Dr.	--	↓	
54	Queue Wait	Ford Dr.	--	↓	
55	Queue Occupancy	Ford Dr.	--	Smoothed 30 s	
56	Reserved	Ford Dr.	--		
57	Capacity	22	--	1 min.	
58	Speed (km/h)	22	--	Latest 30 s	
59	Volume	22	--	1 min.	
60	Occupancy	22	--	1 min.	
61	Incident	22	--	Latest 30 s	
62	Capacity	21	--	1 min.	
63	Speed (km/h)	21	--	Latest 30 s	
64	Volume	21	--	1 min.	
65	Occupancy	21	--	1 min.	
66	Incident	21	--	Latest 30 s	
67	Capacity	20	--	1 min.	
68	Speed (km/h)	20	--	Latest 30 s	
69	Volume	20	--	1 min.	
70	Occupancy	20	--	1 min.	
71	Incident	20	--	Latest 30 s	
72	Capacity	19	--	1 min.	
73	Speed (km/h)	19	--	Latest 30 s	
74	Volume	19	--	1 min.	
75	Occupancy	19	--	1 min.	
76	Incident	19	--	Latest 30 s	
77	Capacity	18	--	1 min.	
78	Speed (km/h)	18	--	Latest 30 s	
79	Volume	18	--	1 min.	
80	Occupancy	18	--	1 min.	
81	Incident	18	--	Latest 30 s	
82	Capacity	17	--	1 min.	
83	Speed (km/h)	17	--	Latest 30 s	
84	Volume	17	--	1 min.	
85	Occupancy	17	--	1 min.	
86	Incident	17	--	Latest 30 s	
87	Capacity	16	--	1 min.	
88	Speed (km/h)	16	--	Latest 30 s	
89	Volume	16	--	1 min.	
90	Occupancy	16	--	1 min.	
91	Incident	16	--	Latest 30 s	

Appendix 29 (Continued)

Word#	Content	Station#	Lane#	Time Slice	Detector#
92	Capacity	15	--	1 min.	
93	Speed (km/h)	15	--	Latest 30 s	
94	Volume	15	--	1 min.	
95	Occupancy	15	--	1 min.	
96	Incident	15	--	Latest 30 s	
97	Capacity	14	--	1 min.	
98	Speed (km/h)	14	--	Latest 30 s	
99	Volume	14	--	1 min.	
100	Occupancy	14	--	1 min.	
101	Incident	14	--	Latest 30 s	
102	Capacity	13	--	1 min.	
103	Speed (km/h)	13	--	Latest 30 s	
104	Volume	13	--	1 min.	
105	Occupancy	13	--	1 min.	
106	Incident	13	--	Latest 30 s	
107	Capacity	12	--	1 min.	
108	Speed (km/h)	12	--	Latest 30 s	
109	Volume	12	--	1 min.	
110	Occupancy	12	--	1 min.	
111	Incident	12	--	Latest 30 s	
112	Capacity	11	--	1 min.	
113	Speed (km/h)	11	--	Latest 30 s	
114	Volume	11	--	1 min.	
115	Occupancy	11	--	1 min.	
116	Incident	11	--	Latest 30 s	
117	Capacity	10	--	1 min.	
118	Speed (km/h)	10	--	Latest 30 s	
119	Volume	10	--	1 min.	
120	Occupancy	10	--	1 min.	
121	Incident	10	--	Latest 30 s	
122	Capacity	9	--	1 min.	
123	Speed (km/h)	9	--	Latest 30 s	
124	Volume	9	--	1 min.	
125	Occupancy	9	--	1 min.	
126	Incident	9	--	Latest 30 s	
127	Capacity	8	--	1 min.	
128	Speed (km/h)	8	--	Latest 30 s	
129	Volume	8	--	1 min.	
130	Occupancy	8	--	1 min.	
131	Incident	8	--	Latest 30 s	
132	Capacity	7	--	1 min.	
133	Speed (km/h)	7	--	Latest 30 s	
134	Volume	7	--	1 min.	
135	Occupancy	7	--	1 min.	
136	Incident	7	--	Latest 30 s	

Appendix 29 (Continued)

Word#	Content		Station#	Lane#	Time Slice	Detector#
137	Capacity		6	--	1 min.	
138	Speed (km/h)		6	--	Latest 30 s	
139	Volume		6	--	1 min.	
140	Occupancy		6	--	1 min.	
141	Incident		6	--	Latest 30 s	
142	Capacity		5	--	1 min.	
143	Speed (km/h)		5	--	Latest 30 s	
144	Volume		5	--	1 min.	
145	Occupancy		5	--	1 min.	
146	Incident		5	--	Latest 30 s	
147	Capacity		4	--	1 min.	
148	Speed (km/h)		4	--	Latest 30 s	
149	Volume		4	--	1 min.	
150	Occupancy		4	--	1 min.	
151	Incident		4	--	Latest 30 s	
152	Capacity		3	--	1 min.	
153	Speed (km/h)		3	--	Latest 30 s	
154	Volume		3	--	1 min.	
155	Occupancy		3	--	1 min.	
156	Incident		3	--	Latest 30 s	
157	Capacity		2	--	1 min.	
158	Speed (km/h)		2	--	Latest 30 s	
159	Volume		2	--	1 min.	
160	Occupancy		2	--	1 min.	
161	Incident		2	--	Latest 30 s	
162	Capacity		1	--	1 min.	
163	Speed (km/h)		1	--	Latest 30 s	
164	Volume		1	--	1 min.	
165	Occupancy		1	--	1 min.	
166	Incident		1	--	Latest 30 s	
167	Volume		15A	--	1 min.	
168	Occupancy		15A	--		
169	Volume	Passage	Cawthra	NB		513
170	Occupancy		Cawthra	NB		513
171	Volume	Demand	Cawthra	NB		514
172	Occupancy		Cawthra	NB		514
173	Volume	Queue	Cawthra	NB		515
174	Occupancy		Cawthra	NB		515
175	Volume	Passage	Cawthra	SB		516
176	Occupancy		Cawthra	SB		516
177	Volume	Demand	Cawthra	SB		517
178	Occupancy		Cawthra	SB		517
179	Volume	Queue	Cawthra	SB		518
180	Occupancy		Cawthra	SB		518
181	Volume	Exit	Cawthra	Exit		519
182	Occupancy		Cawthra	Exit	1 min.	519

Appendix 29 (Continued)

Word#	Content		Station#	Lane#	Time Slice	Detector#
183	Volume	Exit	Cawthra	Exit	1 min.	520
184	Occupancy		Cawthra	Exit		520
185	Volume	Passage	Hwy 10	NB		1
186	Occupancy		Hwy 10	NB		1
187	Volume	Demand	Hwy 10	NB		2
188	Occupancy		Hwy 10	NB		2
189	Volume	Queue	Hwy 10	NB		7
190	Occupancy		Hwy 10	NB		7
191	Volume	Exit	Hwy 10	Service		5
192	Occupancy		Hwy 10	Service		5
193	Volume	Exit	Hwy 10	NB		6
194	Occupancy		Hwy 10	NB		6
195	Volume	Passage	Hwy 10	SB		3
196	Occupancy		Hwy 10	SB		3
197	Volume	Demand	Hwy 10	SB		4
198	Occupancy		Hwy 10	SB		4
199	Volume	Queue	Hwy 10	SB		8
200	Occupancy		Hwy 10	SB		8
201	Volume	Exit	Hwy 10	SB		9
202	Occupancy		Hwy 10	SB		9
203	Volume	Passage	Miss.	NB		28
204	Occupancy		Miss.	NB		28
205	Volume	Demand	Miss.	NB		29
206	Occupancy		Miss.	NB		29
207	Volume	Queue	Miss.	NB		30
208	Occupancy		Miss.	NB		30
209	Volume	Passage	Miss.	SB		31
210	Occupancy		Miss.	SB		31
211	Volume	Demand	Miss.	SB		32
212	Occupancy		Miss.	SB		32
213	Volume	Queue	Miss.	SB E		33
214	Occupancy		Miss.	SB E		33
215	Volume	Queue	Miss.	SB W		34
216	Occupancy		Miss.	SB W		34
217	Volume	Exit	Miss.	Off Ramp		35
218	Occupancy		Miss.	Off Ramp		35
219	Volume	Passage	Southdown	On Ramp		68
220	Occupancy		Southdown	On Ramp		68
221	Volume	Demand	Southdown	On Ramp		69
222	Occupancy		Southdown	On Ramp		69
223	Volume	Queue	Southdown	SB		70
224	Occupancy		Southdown	SB		70
225	Volume	Queue	Southdown	NB		77
226	Occupancy		Southdown	NB		77
227	Volume	Exit	Southdown	Off Ramp		84
228	Occupancy		Southdown	Off Ramp	1 min.	84

Appendix 29 (Continued)

Word#	Content		Station#	Lane#	Time Slice	Detector#
229	Volume	Passage	Winston	NB	1 min.	91
230	Occupancy		Winston	NB		91
231	Volume	Demand	Winston	NB		92
232	Occupancy		Winston	NB		92
233	Volume	Queue	Winston	NB		93
234	Occupancy		Winston	NB		93
235	Volume	Passage	Winston	SB		94
236	Occupancy		Winston	SB		94
237	Volume	Demand	Winston	SB		95
238	Occupancy		Winston	SB		95
239	Volume	Queue	Winston	SB		96
240	Occupancy		Winston	SB		96
241	Volume	Exit	Winston	1		97
242	Occupancy		Winston	1		97
243	Volume	Exit	Winston	2		98
244	Occupancy		Winston	2		98
245	Volume	Passage	Ford Dr.	On Ramp		113
246	Occupancy		Ford Dr.	On Ramp		113
247	Volume	Demand	Ford Dr.	On Ramp		114
248	Occupancy		Ford Dr.	On Ramp		114
249	Volume	Queue	Ford Dr.	SB On		115
250	Occupancy		Ford Dr.	Ramp		115
251	Volume	Queue	Ford Dr.	NB On		116
252	Occupancy		Ford Dr.	Ramp		116
253	Volume	Exit	Ford Dr.	1		135
254	Occupancy		Ford Dr.	1		135
255	Volume	Exit	Ford Dr.	2		136
256	Occupancy		Ford Dr.	2		136
257	Volume		22	Driv		
258	Occupancy		22	Driv		
259	Speed		22	Driv		
260	Volume		22	Centre		
261	Occupancy		22	Centre		
262	Speed		22	Centre		
263	Volume		22	Pass		
264	Occupancy		22	Pass		
265	Speed		22	Pass		
266	Volume		21	Driv		
267	Occupancy		21	Driv		
268	Speed		21	Driv		
269	Volume		21	Centre		
270	Occupancy		21	Centre		
271	Speed		21	Centre		
272	Volume		21	Pass		
273	Occupancy		21	Pass		
274	Speed		21	Pass	1 min.	

Appendix 29 (Continued)

Word#	Content	Station#	Lane#	Time Slice	Detector#
275	Volume	20	Driv	1 min.	
276	Occupancy	20	Driv		
277	Speed	20	Driv		
278	Volume	20	Centre		
279	Occupancy	20	Centre		
280	Speed	20	Centre		
281	Volume	20	Pass		
282	Occupancy	20	Pass		
283	Speed	20	Pass		
284	Volume	19	Driv		
285	Occupancy	19	Driv		
286	Speed	19	Driv		
287	Volume	19	Centre		
288	Occupancy	19	Centre		
289	Speed	19	Centre		
290	Volume	19	Pass		
291	Occupancy	19	Pass		
292	Speed	19	Pass		
293	Volume	18	Driv		
294	Occupancy	18	Driv		
295	Speed	18	Driv		
296	Volume	18	Centre		
297	Occupancy	18	Centre		
298	Speed	18	Centre		
299	Volume	18	Pass		
300	Occupancy	18	Pass		
301	Speed	18	Pass		
302	Volume	17	Driv		
303	Occupancy	17	Driv		
304	Speed	17	Driv		
305	Volume	17	Centre		
306	Occupancy	17	Centre		
307	Speed	17	Centre		
308	Volume	17	Pass		
309	Occupancy	17	Pass		
310	Speed	17	Pass		
311	Volume	16	Driv		
312	Occupancy	16	Driv		
313	Speed	16	Driv		
314	Volume	16	Centre		
315	Occupancy	16	Centre		
316	Speed	16	Centre		
317	Volume	16	Pass		
318	Occupancy	16	Pass		
319	Speed	16	Pass	1 min.	

Appendix 29 (Continued)

Word#	Content	Station#	Lane#	Time Slice	Detector#
320	Volume	15	Driv	1 min.	
321	Occupancy	15	Driv		
322	Speed	15	Driv		
323	Volume	15	Centre		
324	Occupancy	15	Centre		
325	Speed	15	Centre		
326	Volume	15	Pass		
327	Occupancy	15	Pass		
328	Speed	15	Pass		
329	Volume	14	Driv		
330	Occupancy	14	Driv		
331	Speed	14	Driv		
332	Volume	14	Centre		
333	Occupancy	14	Centre		
334	Speed	14	Centre		
335	Volume	14	Pass		
336	Occupancy	14	Pass		
337	Speed	14	Pass		
338	Volume	13	Driv		
339	Occupancy	13	Driv		
340	Speed	13	Driv		
341	Volume	13	Centre		
342	Occupancy	13	Centre		
343	Speed	13	Centre		
344	Volume	13	Pass		
345	Occupancy	13	Pass		
346	Speed	13	Pass		
347	Volume	12	Driv		
348	Occupancy	12	Driv		
349	Speed	12	Driv		
350	Volume	12	Centre		
351	Occupancy	12	Centre		
352	Speed	12	Centre		
353	Volume	12	Pass		
354	Occupancy	12	Pass		
355	Speed	12	Pass		
356	Volume	11	Driv		
357	Occupancy	11	Driv		
358	Speed	11	Driv		
359	Volume	11	Centre		
360	Occupancy	11	Centre		
361	Speed	11	Centre		
362	Volume	11	Pass		
363	Occupancy	11	Pass		
364	Speed	11	Pass	1 min.	

Appendix 29 (Continued)

Word#	Content.	Station#	Lane#	Time Slice	Detector#
365	Volume	10	Driv	1 min.	
366	Occupancy	10	Driv		
367	Speed	10	Driv		
368	Volume	10	Centre		
369	Occupancy	10	Centre		
370	Speed	10	Centre		
371	Volume	10	Pass		
372	Occupancy	10	Pass		
373	Speed	10	Pass		
374	Volume	9	Driv		
375	Occupancy	9	Driv		
376	Speed	9	Driv		
377	Volume	9	Centre		
378	Occupancy	9	Centre		
379	Speed	9	Centre		
380	Volume	9	Pass		
381	Occupancy	9	Pass		
382	Speed	9	Pass		
383	Volume	8	Driv		
384	Occupancy	8	Driv		
385	Speed	8	Driv		
386	Volume	8	Centre		
387	Occupancy	8	Centre		
388	Speed	8	Centre		
389	Volume	8	Pass		
390	Occupancy	8	Pass		
391	Speed	8	Pass		
392	Volume	7	Driv		
393	Occupancy	7	Driv		
394	Speed	7	Driv		
395	Volume	7	Centre		
396	Occupancy	7	Centre		
397	Speed	7	Centre		
398	Volume	7	Pass		
399	Occupancy	7	Pass		
400	Speed	7	Pass		
401	Volume	6	Driv		
402	Occupancy	6	Driv		
403	Speed	6	Driv		
404	Volume	6	R. Centre		
405	Occupancy	6	R. Centre		
406	Speed	6	R. Centre		
407	Volume	6	L. Centre		
408	Occupancy	6	L. Centre		
409	Speed	6	L. Centre	1 min.	

Appendix 29 (Continued)

Word#	Content	Station#	Lane#	Time Slice	Detector#
410	Volume	6	Pass	1 min.	
411	Occupancy	6	Pass		
412	Speed	6	Pass		
413	Volume	5	Driv		
414	Occupancy	5	Driv		
415	Speed	5	Driv		
416	Volume	5	Centre		
417	Occupancy	5	Centre		
418	Speed	5	Centre		
419	Volume	5	Pass		
420	Occupancy	5	Pass		
421	Speed	5	Pass		
422	Volume	4	Driv		
423	Occupancy	4	Driv		
424	Speed	4	Driv		
425	Volume	4	Centre		
426	Occupancy	4	Centre		
427	Speed	4	Centre		
428	Volume	4	Pass		
429	Occupancy	4	Pass		
430	Speed	4	Pass		
431	Volume	3	Driv		
432	Occupancy	3	Driv		
433	Speed	3	Driv		
434	Volume	3	Centre		
435	Occupancy	3	Centre		
436	Speed	3	Centre		
437	Volume	3	Pass		
438	Occupancy	3	Pass		
439	Speed	3	Pass		
440	Volume	2	Driv		
441	Occupancy	2	Driv		
442	Speed	2	Driv		
443	Volume	2	Centre		
444	Occupancy	2	Centre		
445	Speed	2	Centre		
446	Volume	2	Pass		
447	Occupancy	2	Pass		
448	Speed	2	Pass		
449	Volume	1	Driv		
450	Occupancy	1	Driv		
451	Speed	1	Driv		
452	Volume	1	Centre		
453	Occupancy	1	Centre		
454	Speed	1	Centre		
455	Volume	1	Pass		
456	Occupancy	1	Pass		
457	Speed	1	Pass	1 min.	

Appendix 30/ INCLOG File Logical Record Format

Word#	Content	
1	Year	Date of Incident
2	Month	
3	Day	
4	Station No.	Incident location
5	Lane No.	
6	Hour	Incident starting time
7	Minute	
8	Second	
9	Hour	Incident ending time
10	Minute	
11	Second	
12	Incident duration	Incident effect and status
13	Maximum mainline queue length	
14	Downstream volume	
15	Maximum capacity reduction at incident site	
16	Travel time	
17	True or False	
18	Station No.	Incident location as reported by operator
19	Lane No.	
20	Hour	Incident starting time as reported by operator
21	Minute	
22	Seconds	
23	Hour	Incident ending time as reported by operator
24	Minute	
25	Second	

Appendix 31/ ALMREC File Logical Record Format

Word#	Content	
1	Hour	Time of day
2	Minute	
3	Second	
4	Device identification	Identify device type, depending on device type, the meaning of Word No. 5 to 13 is modified
5	Device number	
6	Device location	
7	Device location	
8	Device location	
9	Error Code	
10	Bit position	
11	Type of data	
12	Value	
13	Program identification	
14	Checking period	

Footnote:

1. Device identification word

    1 .... Detector
    2 .... 710 ramp controller
    3 .... 170 ramp controller
    4 .... Ramp signal light
    5 .... Data modem
    6 .... CMS controller or sign

2. If device identification word equals to 1 (i.e., detector), then for a double loop detector (as identified by the device number).

    ALMREC (6) = Station number
    ALMREC (7) = Lane number (starting from driving lane)
    ALMREC (8) = 1 ... for downstream detector
    2 ... for upstream detector

Appendix 31 (Continued)

ALMREC (9) = 1 ... for occupancy
2 ... for volume
ALMREC (11) = 1 ... occupancy type
2 ... volume type

for a single loop detector.
ALMREC (6) = Word No. + 1000
ALMREC (7) = 1 ... for passage detector
2 ... for demand detector
3 ... for exit detector
4 ... for queue detector
5 ... for mainline single loop detector
ALMREC (9) = 1 ... for occupancy
2 ... for volume
ALMREC (11) = 1 ... occupancy type
2 ... volume type

3. If device identification word equal to 2 or 3 (ramp controller), then
ALMREC (6) = ramp number
ALMREC (10) = bit position that is wrong

4. If the device identification word equal to 4 (ramp signal light), then
ALMREC (6) = ramp number
ALMREC (9) = 0 ... No lights were on during past 30 s
2 ... Only green light was on during past 30 s
3 ... Only amber light was on during past 30 s
4 ... Only red light was on during past 30 s
5 ... Only green and amber lights were on during past 30 s
6 ... Only green and red lights were on during past 30 s
7 ... Only amber and red lights were on during past 30 s
9 ... Green, amber, and red lights were on
ALMREC (11) = 1 ... In permanent green cycle
2 ... Normal metering cycle

Appendix 31 (Continued)

5. If device identification word equal to 5 (data modem), then

ALMREC (5) = octal modem address
(6) = modem number
ALMREC (9) = 1 MODEMT (4 ~ 76) 0
2 MODEMH > 0
3 BOTH
ALMREC (12) = MODEMH Value
ALMREC (13) = 3
ALMREC (14) = 600 s

6. If the device identification word equal to 6 (CMS), then

ALMREC (6) = first CMS

7. Program identification word

1 ALM30S
2 ALM5M
3 AMODM

Appendix 32/ XMTTAB File Logical Record Format

Word#	Content
1	Year
2	Month
3	Day
4	Hour
5	Minute
6	Second
7	Left byte : NUL; Right byte : CMS modem address (octal)
8	Left byte : SOH; Right byte : BEL
9	2 ASCII characters First line message
10	" " " " "
11	" " " " "
12	" " " " "
13	" " " " "
14	" " " " "
15	" " " " "
16	" " " " "
17	" " " " "
18	" " " " "
19	" " " " "
20	Left byte : CR; Right byte : LF
21	2 ASCII characters Second line message
22	" " " " "
23	" " " " "
24	" " " " "
25	" " " " "
26	" " " " "
27	" " " " "
28	" " " " "
29	" " " " "
30	" " " " "
31	" " " " "
32	Left byte : ETX; Right byte : NUL

Appendix 32 (Continued)

Word#	Content
33	Unused
34	"
35	"
36	"
37	"
38	"
39	"
40	"
41	"
42	"
43	"
44	"
45	"
46	"
47	"
48	"
49	"
50	"
51	"

Appendix 33/ RESDEV File Logical Record Format

Word#	Content	
1	Year	Date
2	Month	
3	Day	
4	Hour	Time of day
5	Minute	
6	Second	
7	Station No.	Incident Location
8	Lane No.	
9	Incident Occupancy Threshold Value	Various incident threshold value
10	Incident Volume Threshold Value	
11	Incident Speed Threshold Value	
12	Occupancy Vote weighting factor	Weighting factor to be used in weighting VTLU results
13	Volume vote weighting factor	
14	Speed vote weighting factor	
15	Occupancy CLDU time slice T vote	Voting result from occupancy CLDU
16	Occupancy CLDU time slice T-1 vote	
17	Occupancy CLDU time slice T-2 vote	
18	Result of majority decision rule based on occupancy VTLU	Result from occupancy VTLU
19	Volume CLDU time slice T vote	Voting result from volume CLDU
20	Volume CLDU time slice T-1 vote	
21	Volume CLDU time slice T-2 vote	
22	Result of majority decision rule based on volume VTLU	Result from volume VTLU

Appendix 33 (Continued)

Word #	Content
23	Speed CLDU time slice T vote ..... Voting result from speed CLDU
24	Speed CLDU time slice T-1 vote
25	Speed CLDU time slice T-2 vote
26	Result of majority decision rule based on speed VTLU ...... Result from speed VTLU

Appendix 34/ WEATHER File Logical Record Format

Word#	Content	
1	Year	Date
2	Month	
3	Day	
4	Hour	Time
5	Minute	
6	Second	
7	W ; :	Weather
8	ASCII characters	
9	"	
10	"	
11	"	
12	"	
13	"	
14	"	
15	"	
16	"	
17	P ; :	Pavement
18	ASCII characters	
19	"	
20	"	
21	"	
22	"	
23	"	
24	"	
25	"	
26	"	
27	V ; ;	Visibility
28	ASCII characters	
29	"	
30	"	
31	"	
32	"	

Appendix 34 (Continued)

Word#	Content
33	ASCII characters
34	"
35	"
36	"

Appendix 35/ First Physical Record Format of Data File

DATA30 - First physical record format

Word#	Content	
1	D ; A	File name
2	T ; A	
3	3 ; 0	
4	SP ; SP	
5	Year	Date
6	Month	
7	Day	
8	128	Physical record length (byte)
9	12	Number of physical record per logical record
10	718	Logical record length (word)
11	KL30S	Number of physical record
12-64	Unused	

Appendix 35 (Continued)

DATA5M - First physical record format

Word#	Content	
1	D ; A	File name
2	T ; A	
3	5 ; M	
4	SP ; SP	
5	Year	Date
6	Month	
7	Day	
8	128	Physical record length (byte)
9	7	Number of physical record per logical record
10	430	Logical record length (word)
11	K5M	Number of physical record
12-64	Unused	

Appendix 35 (Continued)

QEWDYN - First physical record format

Word#	Content	
1	Q ; E	File name
2	W ; D	
3	Y ; N	
4	SP ; SP	
5	Year	Date
6	Month	
7	Day	
8	128	Physical record length (byte)
9	8	Number of physical record per logical record
10	457	Logical record length (word)
11	KD1SP	Number of physical record
12-64	Unused	

Appendix 35 (Continued)

INCLOG - First physical record format

Word#	Content	
1	I ; N	File name
2	C ; L	
3	O ; G	
4	SP ; SP	
5	Year	Date
6	Month	
7	Day	
8	50	Physical record length (byte)
9	1	Number of physical record per logical record
10	25	Logical record length (word)
11	KINC	Number of physical record
12-25	Unused	

Appendix 35 (Continued)

ALMREC - First physical record format

Word#	Content	
1	A ; L	File name
2	M ; R	
3	E ; C	
4	SP ; SP	
5	Year	Date
6	Month	
7	Day	
8	28	Physical record length (byte)
9	1	Number of physical record per logical record
10	14	Logical record length (word)
11	NALREC	Number of physical record
12-14	Unused	

Appendix 35 (Continued)

XMTTAB - First physical record format

Word#	Content	
1	X ; M	File name
2	T ; T	
3	A ; B	
4	SP ; SP	
5	Year	Date
6	Month	
7	Day	
8	102	Physical record length (byte)
9	1	Number of physical record per logical record
10	51	Logical record length (word)
11	NMSGTX	Number of physical record
12-51	Unused	

Appendix 35 (Continued)

RESDEV - First physical record format

Word#	Content	
1	R ; E	File name
2	S ; D	
3	E ; V	
4	SP ; SP	
5	Year	Date
6	Month	
7	Day	
8	52	Physical record length (byte)
9	1	Number of physical record per logical record
10	26	Logical record length (word)
11	-	Number of physical record
12-26	Unused	

Appendix 35 (Continued)

WEATHER - First physical record format

Word#	Content	
1	W ; E	File name
2	A ; T	
3	H ; E	
4	SP ; SP	
5	Year	Date
6	Month	
7	Day	
8	72	Physical record length (byte)
9	1	Number of physical record per logical record
10	36	Logical record length (word)
11	NWREC	Number of physical record
12-36	Unused	

Appendix 35 (Continued)

MSGFILE - File Logical Record Format

Word#	Content
1	Left byte : NUL; Right byte : CMS modem address (octal)
2	Left byte : SOH; Right byte : BEL
3	2 message characters (ASCII)
4	" "
5	" "
6	" "
7	" "
8	" "
9	" "
10	" "
11	" "
12	" "
13	" "
14	Left byte: CR; Right byte: LF
15	2 message characters (ASCII)
16	" "
17	" "
18	" "
19	" "
20	" "
21	" "
22	" "
23	" "
24	" "
25	" "
26	Left byte: ETX; Right byte: NUL
27-45	Unused

APPENDIX 36/"QEW" Source Program Listing

```
C
C     PROGRAM QEW
C
C
      EXTERNAL QINITIALIZE,QHEADING
C
C
C
C
C                                     OPEN OVERLAY FILE
C
      CALL OVOPN (1, 'QEW.OL', IER)
      IF (IER .NE. 1)
   *    TYPE "'QEW.OL' OVOPN IER =", IER
C
C                                     INITIALIZE TASKS AND FILES
C
      CALL FOVLD(1,QINITIALIZE,0,IER)
      CALL INITIALIZE
      CALL FOVRL(QINITIALIZE,IER)
C
C                                     PRINT HEADING
C
      CALL FOVLD(1,QHEADING,0,IER)
      CALL HEADING
      CALL FOVRL(QHEADING,IER)
C
C
      CALL TOPCOM
C
C                                     CLOSE OVERLAY FILE
C
      CALL CLOSE (1, IER)
      IF (IER .NE. 1)
   *    TYPE "'QEW.OL' CLOSE IER =", IER
C
C                                     END OF ROUTINE
C
      STOP
      END
```

```
C
C       SUBPROGRAM GEWBLK
        BLOCK DATA
C
C       THIS IS THE BLOCK DATA SUB-PROGRAM FOR 'GEW'.
C
C       COMMON STATEMENTS:
C
C       COMMON /ALARM/ NOBEEP, ALMBEEP
C          USED IN: ALM30S,ALMSM,AMODM,T17A,TRANSF
C
C       COMMON /ALM1/ APARM
C          USED IN: ALM30S,ALMSM,NXFER
C
C       COMMON /BLOK1/ FT14D
C          USED IN: T14C,T14D,TOPCOM
C
C       COMMON /COMM/ DETECT,NDETRC,NOKEY
C          USED IN: COMCOM,DATAIN,MODM1,RAMCON,T18A
C
C       COMMON /CREST/ M,N
C          USED IN: RAMPS,RDISMAP
C
C       COMMON /CTRL1/ CONTRL,MAXCYC,METER,MODCYC
C          USED IN: DIS2,GMAP,QUOCC,RAMCON,RCTIME,T12A,T13,UPD30S
C
C       COMMON /CTRL2/ CYCOVR,RAMCYC
C          USED IN: ALM30S,DIS2,QUOCC,RAMCON,RCTIME,T12A,UPD30S
C
C       COMMON /CTRL3/ CNTADR,CSTAT,LTSTAT
C          USED IN: ALM30S,RAMCON,T17A,T17B,T16B
C
C       COMMON /CTRL4/ CHEK1,CHEK2,LIGHTS
C          USED IN: ALM30S,NXFER,RAMCON
C
C       COMMON /CTRL5/ THRCP,CTRMOD
C          USED IN: RCTIME,T12A
C
C       COMMON /CTRL6/ COMDOP,CNTON,NBRAMP
C          USED IN: COMCOM,RAMCON,T19A
C
C       COMMON /CTRL7/ ERRCNT,DFREQ
C          USED IN: DATAIN, RAMCON
C
C       COMMON /CTRL9/ MCNT
C          USED IN: DATAIN,RAMCON
C
C       COMMON /D15/ VOL1S,OCC1S,DVOL1S,UVOL1S,DOCC1S,UOCC1S,VSPEED,LVC1S,LTCOND
C          USED IN: DATAIN,NXFER
C
C       COMMON /D30/ DATA30
C          USED IN: ALM30S,DIS1,DIS2,DYS1,INCDET,INITIALIZE,NXFER,PERCHK,QUOCC,RCTIME,
C            T16D,UPD30S,WOOD30
C
C       COMMON /DINDX/ XREFTB,XREF
C          USED IN: ALM30S,ALMSM,MODM1,NXFER,T16D,T17B,WOOD30
C
C       COMMON /ERRP/ PR1ERR,PR2ERR,PR3ERR,PR4ERR,PR5ERR
C          USED IN: COMCOM,MODM1
C
C       COMMON /ET/ STIM1,DTIM1,DTIM2,UPTIM
C          USED IN: DATAIN,NXFER
C
C       COMMON /EXTRA/ WINSTON
C          USED IN: DISMAP,IOC2,SPD2
C
C       COMMON /GEOM/ STOT,DTOT,NRAMPS,NSTNS,CAP
C          USED IN: ACCIDENT,ALM30S,ALMSM,CHOOR,DATAIN,DIS1,DIS2,DYS1,
C            FACC,FLASH,GMAP,INCDET,NXFER,PERCHK,QOCC,QSPD,QUOCC,
C            RAMCON,RAMPS,RCTIME,T16D,UPD30S,WOOD30
C
C       COMMON /GRAPH/ MAPNUM,LMAP
C          USED IN: DISMAP,GMAP,RAMPS,SPD2,T15
C
C       COMMON /INCA/ INCTV,INCREC,INCFLAG,INCSTAT
C          USED IN: CLDU,DATSTR,DIS2,INCDET,PERCHK,T16A,VTLU
C
C       COMMON /INCB/ OCCDBI,OCCUBI,INCNT,INCONT,INCEX
C          USED IN: INCDET,PERCHK,T17A,TRANSF
C
C       COMMON /INCC/ THRMOL
C          USED IN: INCDET,PERCHK
C
C       COMMON /INCD/ INCPRG,INCDT,INCVT,INCST
```

```
C        USED IN: CLDU.DATSTR.INCDET.VTLU
C
      COMMON /INCE/ CHCK.CMNI1.CMNJ.TEST3
C        USED IN: INCDET.PERCHK
C
      COMMON /INCTD/ ACC.ALOC.AFLG
C        USED IN: ACCIDENT.DETECTOR.FACC.FLASH.GMAP
C
      COMMON /KLOCK/ TIMER
C        USED IN: CLOCK.COMCOM
C
      COMMON /LIMTTS/ MAXOCC.MAXSPD.IMIN.MAXVEH.STDLN.S1.S2
C        USED IN: DATAIN.OLCHEK.MODM1.NXFER.SLCHEK
C
      COMMON /LOOPL/ LDIST
C        USED IN: DATAIN
C
      COMMON /MO/ MODEMT.MODEM.MODEM1.NUMMOM
C        USED IN: AMODM.COMCOM.MODM1.T16C.T17A.T17B.T18A
C
      COMMON /MONO/ MODNO
C        USED IN: AMODM
C
      COMMON /MOTBL/NERROR.MOMDET.XTB
C        USED IN: MODM1
C
      COMMON /NACC/ KCNT
C        USED IN: FLASH.LOOP
C
      COMMON /NREC/ KL30S.NWREC.KINC.K5M.NALREC.KDISP
C        USED IN: ALM30S.ALM5M.AMODM.CLDU.DATSTR.DIS1.DIS2.DYS1.HEADING.
C          INCDET.INITIALIZE.PERCHK.REQEW.T16A.T16B.T16C.T16D.
C          T18A.T18B.T18C.T18D.UPD30S.WOOD30
C
      COMMON /OCCRM/ OCC.RMETER
C        USED IN: DISMAP.GMAP.QOCC.RDISMAP.T15
C
      COMMON /OPTA/ ISDL.ISCL.ISPL
C        USED IN: DISMAP.GMAP.SPD1.SPD2
C
      COMMON /OPTB/ IODL.IOCL.IOPL
C        USED IN: DISMAP.GMAP.IOCC
C
      COMMON /PROT/ CONMSG.REPLY.PROTOCOL.MSGID.KTIME.PSPRT
C        USED IN: COMCOM.MODM1
C
      COMMON/QEWDATA/ QEW
C        USED IN: ACCIDENT.BOX2.BOX3.CHQOR.DISMAP.IOC2.IOCC.QOCC.QSPD.
C          REQEW.SPD1.SPD2
C
      COMMON /QQ1/ QOVR.QIND
C        USED IN: CHQOR.QUOCC.RCTIME.T13
C
      COMMON /QQ2/ QWAIT.QLNTH
C        USED IN: DIS2.QUOCC.RCTIME.T13.UPD30S
C
      COMMON /QQ3/ KQCNT.KSTEP.KTLMT.KTHR
C        USED IN: QUOCC.T13
C
      COMMON /QQ4/ QOCCLB.QOCCUB
C        USED IN: CHQOR.QUOCC.T13
C
      COMMON /QOC/ QOCC
C        USED IN: DIS2.QUOCC.RCTIME.T13
C
      COMMON /RANGE/ UPRNGE.DNRNGE
C         USED IN: OLCHEK.SLCHEK.T18A
C
      COMMON /RDET/ NPD.NOD.NED.NQD
C        USED IN: ALM5M.DIS1.DYS1.QUOCC.RCTIME
C
      COMMON /RDFIL/ RDRCD.RSOVR
C        USED IN: CLDU.DIS2.INITIALIZE.T18C.T18D.VTLU
C
      COMMON /RQOR/ NOTIN.INHL.INAB
C        USED IN: CHQOR.RAMPS
C
      COMMON /SCREEN/ GCHN.PFILE.RQEW.RWTEMP
C        USED IN: BOX1.BOX2.BOX3.DETECTOR.DISMAP.FLASH.GMAP.INITIALIZE.
C          IOC2.IOCC.LOOP.QOCC.QSPD.RAMPS.RDISMAP.REQEW.SPD1.SPD2.
C          T18C.TRANSF
C
      COMMON /SECTL/ DIST
C        USED IN: INCDET.PERCHK.UPD30S
C
```

```
          COMMON /SGN1/ XMTBUF,RCVBUF,SGNADR
C           USED IN: ALM30S,COMCOM,INITIALIZE,T14A,T14B,T14C,T14D,T18A
C
          COMMON /SGN2/ NWORDS,BUFSIZ,NMSGTX,NMSGRX,MTLSGN
C           USED IN: COMCOM,DIS2,INITIALIZE,T14A,T14B,T14C,T14D,T18C,T18D
C
          COMMON /SGN3/ SGNSTAT,ALMFLG,KCNTD,P4FLG,AMODE
C           USED IN: ALM30S,COMCOM,T14C,T14D,T17A,T17B
C
          COMMON /ST1S/ LATST,ERRARD,IDATA
C           USED IN: DATAIN,DLCHEK,SLCHEK
C
          COMMON /TC/ IMIN10
C           USED IN: TRANSF
C
          COMMON /TCNT/ COUNT,KCNTSM,IMINS,KCOUNT
C           USED IN: ALMSM,DIS1,DYS1,TRANSF,UPD30S
C
          COMMON /TSKSYN/ TSK0,TSK1,TSK2,TSK3
C           USED IN: ALMSGN,COMCOM,DATAIN,GMAP,T14D,TRANSF
C
          COMMON /TTS/ TT
C           USED IN: INCDET,PERCHK,UPD30ST
C
          COMMON /WKDAY/ HMS,MDY
C           USED IN: ALM30S,ALMSM,AMODM,CLDU,DATSTR,DIS1,DYS1,HEADING,INCDET,INITIALZIE,
C             PERCHK,RCTIME,T14D,T16A,T16B,T16C,T16D,T18B,T18D,TRANSF,UPD30S
C
          COMMON /WORDS/ NSTA,NCON,IS,IV,IO,RO,RV,TXT,K,K1
C           USED IN: BOX1,BOX2,BOX3,DISMAP,FLASH,GMAP,IOC2,IOCC,
C             WOCC,WSPD,RAMPS,WDISMAP,SPD1,SPD2
C
          COMMON /WPV/ WEATHER
C           USED IN: HEADING,T16A,T18B
C
C
C
C
C
C
C
C         DECLARATION STATEMENTS:
C
C
          LOGICAL ACC(22)                       !/INCID/
C           TRUE IF ACCIDENT OCCURRED AT THIS STATION
C
          LOGICAL AFLG                          !/INCID/
C           TRUE IF ACCIDENT PRESENT AT 1 OR MORE STATIONS
C
          INTEGER ALMBEEP                       !/ALARM/
C           ?ALARM BEEP
C
          INTEGER ALOC(3)                       !/INCID/
C           ACCIDENT LOCATIONS
C
          INTEGER ALMFLG                        !/SGN3/
C           ?ALARM FLAG
C
          INTEGER AMODE                         !/SGN3/
C           ?ALARM MODE
C
          INTEGER APARM(6)                      !/ALM1/
C           ?ALARM PARAMETERS
C
          INTEGER BUFSIZ                        !/SGN2/
C           BUFFER SIZE (IN WORDS) OF CMS MESSAGE
C
          INTEGER CAP(22)                       !/GEOM/
C           CAPACITY OF EACH STATION
C
          INTEGER CHCK(21)                      !/INCE/
C           ?
C
          INTEGER CHEK1(10),CHEK2(10)           !/CTRL4/
C           CHECKS FOR TRANSMISSION ERRORS WITH EACH RAMP CONTROLLER
C
          INTEGER CMNI1(21),CMNJ(21)            !/INCE/
C           SAVE I1,J
C
          INTEGER CNTADR(10)                    !/CTRL3/
C           CONTROLLER ADDRESS FOR EACH RAMP
C
          INTEGER CNTON(10)                     !/CTRL6/
C           = 1 IF CONTROLLER ON FOR THIS RAMP
C
          INTEGER COMDOP(8)                     !/CTRL6/
```

```
C         ?COMMAND OPERATOR
C
        INTEGER CONMSG(2)               :/PROT/
C         CONTROL MESSAGE TO ISI/3M 310 HEAD-END MODEM
C
        INTEGER CONTRL                  :/CTRL1/
C         CONTROL
C
        INTEGER COUNT                   :/TCNT/
C         30-SEC. COUNTER ?
C
        INTEGER CSTAT(10)               :/CTRL3/
C         CONTROLLER STATUS (0=OK, 1=FAIL) OF EACH RAMP
C
        INTEGER CTRMOD                  :/CTRL5/
C         ?CONTROLLER MODE
C
        INTEGER CYCOVR(10)              :/CTRL2/
C         CYCLE OVER-RIDE OF EACH RAMP
C
        INTEGER DATA30(718)             :/D30/
C         RECORD IN FILE 'DATA30'
C
        INTEGER DETECT(545)             :/COMM/
C         DETECTOR DATA
C
        INTEGER DFREQ                   :/CTRL7/
C         ?DATA FREQUENCY
C
        INTEGER DIST(20)                :/SECTL/
C         DISTANCE (IN METRES)
C
        INTEGER DNRNGE(67,3)            :/RANGE/
C         DOWNSTREAM RANGE FOR EACH DOUBLE-LOOP DETECTOR
C
        INTEGER DOCC1S(67)              :/D1S/
C         DOWNSTREAM 1-SEC. OCCUPANCY VALUES FOR EACH DOUBLE-LOOP DETECTOR
C
        INTEGER DTIM1(67),DTIM2(67)     :/ET/
C         AVERAGE ELAPSED TIMES FOR EACH DOUBLE-LOOP DETECTOR
C
        INTEGER DTOT                    :/GEOM/
C         TOTAL NUMBER OF DOUBLE-LOOP DETECTORS
C
        INTEGER DVOL1S(67)              :/D1S/
C         DOWNSTREAM 1-SEC. VOLUME VALUES FOR EACH DOUBLE-LOOP DETECTOR
C
        INTEGER ERHARD                  :/ST1S/
C         ?
C
        INTEGER ERRCNT(10)              :/CTRL7/
C         ERROR COUNT OF EACH RAMP
C
        INTEGER FT140                   :/BLOK1/
C         FLAG TO SUBR 'FT140'
C
        INTEGER GCHN                    :/SCREEN/
C         GRAPHICS CHANNEL
C
        INTEGER HMS(3)                  :/WKDAY/
C         HOUR, MINUTE, SECOND
C
        INTEGER IDATA                   :/ST1S/
C         ?
C
        INTEGER IMIN                    :/LIMITS/
C         1-MIN. FLAG
C
        INTEGER IMIN5                   :/TCNT/
C         5-MIN. FLAG
C
        INTEGER IMIN10                  :/TC/
C         10-MIN. FLAG
C
        LOGICAL INAB(10)                :/RQOR/
C         TRUE IF THIS RAMP IN QUEUE OVER-RIDE AND ABOVE UPPER BOUND
C
        LOGICAL INBL(10)                :/RQOR/
C         TRUE IF THIS RAMP IN QUEUE OVER-RIDE AND BELOW LOWER BOUND
C
        INTEGER INCONT                  :/INCB/
C         INCIDENT
C
        INTEGER INCEX                   :/INCB/
C         INCIDENT ?
```

```
C
      INTEGER INCFLAG(21)               !/INCA/
C       INCIDENT FLAG FOR EACH ?
C
      INTEGER INCNT(21)                 !/INCB/
C       INCIDENT COUNT FOR EACH ?
C
      INTEGER INCOT,INCST,INCVT         !/INCD/
C       INCIDENT OCCUPANCY, SPEED, VOLUME TOTALS
C
      INTEGER INCPRG(21)                !/INCD/
C       INCIDENT FOR EACH ?
C
      INTEGER INCREC(21)                !/INCA/
C       INCIDENT RECORD FOR EACH ?
C
      INTEGER INCSTAT(21)               !/INCA/
C       INCIDENT STATUS FOR EACH ?
C
      INTEGER INCTV(84)                 !/INCA/
C       INCIDENT THRESHOLD VALUES, 4 PER STATION, EXCLUDING MOST DOWNSTREAM
C
      INTEGER IO,IS,IV                  !/WORDS/
C       INDICES IN 'QEW' RECORD FOR MAINLINE STATION OCCUPANCY, SPEED, AND VOLUME
C
      INTEGER IOCL,IODL,IOPL            !/OPTA/
C       INDICES IN 'QEW' RECORD FOR OCCUPANCY IN CENTRE, DRIVING, AND PASSING LANES
C
      INTEGER ISCL,ISDL,ISPL            !/OPTA/
C       INDICES IN 'QEW' RECORD FOR SPEED IN CENTRE, DRIVING, AND PASSING LANES
C
      INTEGER K,K1                      !/WORDS/
C       CONTINUATION CHARACTERS FOR GRAPHICS COMMANDS
C
      INTEGER K5M                       !/NREC/
C       NUMBER OF RECORDS IN FILE 'DATA5M'
C
      INTEGER KCNT                      !/NACC/
C       ACCIDENT COUNT
C
      INTEGER KCNT5M                    !/TCNT/
C       5-MIN. COUNTER, RESET EVERY 15 MIN.
C
      INTEGER KCNTO                     !/SGN3/
C       ?
C
      INTEGER KCOUNT                    !/TCNT/
C       30-SEC. COUNTER FOR GRAPHICS ROUTINES
C
      INTEGER KDTSP                     !/NREC/
C       NUMBER OF RECORDS IN FILE 'QEWDYN'
C
      INTEGER KINC                      !/NREC/
C       NUMBER OF RECORDS IN FILE 'INCLOG'
C
      INTEGER KL30S                     !/NREC/
C       NUMBER OF RECORDS IN FILE 'DATA30'
C
      INTEGER KQCNT(10)                                 !/Q03/
C       QUEUE COUNT ?
C
      INTEGER KSTEP(10)                 !/Q03/
C       STEP FOR EACH RAMP
C
      INTEGER KTHR                      !/Q03/
C       ?
C
      INTEGER KTIME                     !/PROT/
C       10-MIN. COUNTER (RE-SET VIA 'PSPRT')
C
      INTEGER KTLMT(10)                 !/Q03/
C       TIME LIMIT FOR EACH RAMP
C
      INTEGER LATST                     !/ST1S/
C       LANE TEST: =1 IF NOT TO COMPUTE SPEED
C
      INTEGER LDIST(67)                 !/LOOPL/
C       LOOP DISTANCES (IN 10*METRES) FOR EACH DOUBLE-LOOP DETECTOR
C
      INTEGER LIGHTS(10)                !/CTRL4/
C       LIGHTS FOR EACH RAMP
C
      INTEGER LMAP                      !/GRAPH/
C       LAST MAP
C
```

```
      INTEGER LTCOND(10)              !/D1S/
C       LIGHT CONDITIONS FOR EACH RAMP
C
      INTEGER LTSTAT(10)              !/CTRL3/
C       LIGHT STATUS FOR EACH RAMP
C
      INTEGER LVC1S(67)               !/D1S/
C       1-SEC. LANE VOLUME COUNTS FOR EACH DOUBLE-LOOP DETECTOR
C
      INTEGER M,N                     !/CREST/
C       INDICES IN 'NEW' RECORD OF FROM AND TO RAMP NUMBERS
C
      INTEGER MAPNUM                  !/GRAPH/
C       MAP NUMBER
C
      INTEGER MAXCYC                  !/CTRL1/
C       MAXIMUM NUMBER OF CYCLES
C
      INTEGER MAXOCC                  !/LIMITS/
C       MAXIMUM OCCUPANCY
C
      INTEGER MAXSPD                  !/LIMITS/
C       MAXIMUM SPEED
C
      INTEGER MAXVEH                  !/LIMITS/
C       MAXIMUM NUMBER OF VEHICLES
C
      INTEGER MCNT(10)                !/CTRL9/
C       MAXIMUM COUNT FOR EACH RAMP
C
      INTEGER MUMDET(73)              !/MDTBL/
C       DETECTOR LOCATION OF EACH MODEM
C
      INTEGER MDY(3)                  !/WKDAY/
C       MONTH, DAY, YEAR
C
      INTEGER METER(10)               !/CTRL1/
C       = 1 IF METERING ON THIS RAMP
C
      INTEGER MODCYC(10)              !/CTRL1/
C       MODEM CYCLE FOR EACH RAMP
C
      INTEGER MODEM(148)              !/MD/
C       MODEM DATA
C
      INTEGER MODEM1(73)              !/MD/
C       ?
C
      INTEGER MODEMT(299)             !/MD/
C       MODEM TEST DATA
C
      INTEGER MODNO(73)               !/MDNO/
C       NUMBER OF EACH MODEM
C
      INTEGER MSGID                   !/PROT/
C       MESSAGE IDENTIFIER
C
      INTEGER MTLSGN(2)               !/SGN2/
C       ? FOR EACH SIGN
C
      INTEGER NALREC                  !/NREC/
C       NUMBER OF RECORDS IN FILE 'ALMREC'
C
      INTEGER NBRAMP                  !/CTRL6/
C       = 1 IF NORTH-BOUND RAMP
C
      INTEGER NCON                    !/WORDS/
C       NUMBER OF RAMP CONTROLLER POLYGONS ON INTERCHANGE MAP
C
      INTEGER NDD,NED                 !/RDET/
C       NUMBER OF DEMAND, EXIT DETECTORS
C
      INTEGER NOFTRC                  !/COMM/
C       NUMBER OF DETECT RECORDS
C
      INTEGER NOKEY                   !/COMM/
C       MESSAGE KEY BETWEEN 'COMCOM' & 'T1RA'
C
      INTEGER NERROR(73)              !/MDTBL/
C       NUMBER OF ERRORS FOR EACH MODEM
C
      INTEGER NMSGRX,NMSGTX           !/SGN2/
C       NUMBER OF CMS MESSAGES RECEIVED, TRANSMITTED
C
      INTEGER NOBEEP                  !/ALARM/
```

```
C       ?NO BEEP
C
      LOGICAL NOTIN(10)                   !/RQOR/
C       TRUE IF THIS RAMP IN QUEUE OVER-RIDE
C
      INTEGER NPD,NQD                     !/RDET/
C       NUMBER OF PASSAGE, QUEUE DETECTORS
C
      INTEGER NRAMPS                      !/GEOM/
C       NUMBER OF RAMPS
C
      INTEGER NSTA                        !/WORDS/
C       NUMBER OF DETECTOR STATIONS FOR INTERCHANGE MAP
C
      INTEGER NSTNS                       !/GEOM/
C       NUMBER OF MAINLINE DETECTOR STATIONS
C
      INTEGER NUMMDM                      !/MD/
C       NUMBER OF MODEMS
C
      INTEGER NWORDS                      !/SGN2/
C       NUMBER OF WORDS IN CMS MESSAGE
C
      INTEGER NWREC                       !/NWREC/
C       NUMBER OF RECORDS IN FILE 'WEATHER'
C
      LOGICAL OCC                         !/OCCRM
C       TRUE IF COLOR BASED ON OCCUPANCY
C
      INTEGER OCC1S(46)                   !/O1S/
C       1-SEC. OCCUPANCY VALUES FOR EACH SINGLE-LOOP DETFCTOR
C
      INTEGER OCCDBI(21),OCCUBI(21)       !/INCB/
C       DOWNSTREAM, UPSTREAM OCCUPANCY FOR EACH ?
C
      INTEGER P4FLG                       !/SGN3/
C       PROTOCOL 4 FLAG
C
      INTEGER PFILE                       !/SCREEN/
C       CHANNEL FOR POLYGON FILES
C
      INTEGER PR1ERR,PR2ERR,PR3ERR,PR4ERR,PR5ERR       !/ERRP/
C       ERROR COUNT FOR PROTOCOLS 1,2,3,4,5
C
      INTEGER PROTOCOL                    !/PROT/
C       PROTOCOL NUMBER
C
      INTEGER PSPRT                       !/PROT/
C       NUMBER OF SECONDS IN 10 MIN. (RE-SETS 'KTIME')
C
      INTEGER QEW(512)                    !/QEWDATA/
C       RECORD IN FILE 'QEWDYN'
C
      INTEGER QIND(10)                    !/QO1/
C       = 1 IF QUEUE OVER-RIDE FOR THIS RAMP
C
      INTEGER QLNTH(10)                   !/QO2/
C       QUEUE LENGTH FOR EACH RAMP
C
      INTEGER QOCC(13)                    !/QOC/
C       SMOOTHED QUEUE DETECTOR OCCUPANCY
C
      INTEGER QOCCLB(10),QOCCUB(10)       !/QO4/
C       QUEUE OCCUPANCY LOWER, UPPER BOUND FOR EACH RAMP
C
      INTEGER QOVR(10)                    !/QO1/
C       QUEUE OVER-RIDE FOR EACH RAMP
C
      INTEGER QWAIT(10)                   !/QO2/
C       QUEUE WAIT FOR EACH RAMP
C
      INTEGER RAMCYC(10)                  !/CTRL2/
C       CYCLE FOR EACH RAMP
C
      INTEGER RCVBUF(45)                  !/SGN1/
C       RECEIVE BUFFER FROM CMS
C
      INTEGER RDRCD                       !/RDFIL/
C       NUMBER OF RECORDS IN FILE 'RESDEV'
C
      INTEGER REPLY(2)                    !/PROT/
C       REPLY FROM ISI/3M 310 HEAD-END MODEM
C
      LOGICAL RMETER(10)                  !/OCCRM/
C       TRUE IF METERING ON THIS RAMP
```

```
C
      INTEGER RO,RV                    !/WORDS/
C       INDICES IN 'QEW' RECORD OF RAMP OCCUPANCY AND VOLUME VALUES
C
      INTEGER RQEW                     !/SCREEN/
C       CHANNEL FOR 'QEWDYN' FILE
C
      INTEGER RSDVR(21)                !/RDFIL/
C       ?
C
      INTEGER RWTEMP                   !/SCREEN/
C       CHANNEL FOR 'TEMPFILE' FILE
C
      INTEGER S1,S2                    !/LIMITS/
C       ?
C
      INTEGER SGNADR(2)                !/SGN1/
C       ADDRESS OF EACH SIGN
C
      INTEGER SGNSTAT(2)               !/SGN3/
C       STATUS OF EACH SIGN
C
      INTEGER STDLN                    !/LIMITS/
C       STANDARD LENGTH (IN 10*M.) OF VEHICLE
C
      INTEGER STIM1(46)                !/ET/
C       1-SEC. TIMES FOR EACH SINGLE-LOOP DETECTOR
C
      INTEGER STOT                     !/GEOM/
C       TOTAL NUMBER OF SINGLE-LOOP DETECTORS
C
      INTEGER TEST3                    !/INCE/
C       3RD TEST STATISTIC FOR INCIDENT DETECTION & CONFIRMATION
C
      INTEGER THRCP(4)                 !/CTRLS/
C       ?
C
      INTEGER THRMOL                   !/INCC/
C       ?
C
      INTEGER TIMER                    !/KLOCK/
C       MESSAGE KEY FROM 'CLOCK' TO 'COMCOM'
C
      INTEGER TSK0                     !/TSKSYN/
C       MESSAGE KEY FROM 'DATAIN' TO 'ALMSGN'
C
      INTEGER TSK1                     !/TSKSYN/
C       MESSAGE KEY FROM 'DATAIN' TO 'TRANSF'
C
      INTEGER TSK2                     !/TSKSYN/
C       MESSAGE KEY FROM 'TRANSF' TO 'GMAP'
C
      INTEGER TSK3                     !/TSKSYN/
C       MESSAGE KEY FROM 'COMCOM' TO 'T140'
C
      INTEGER TT(20)                   !/TTS/
C       ?
C
      INTEGER TXT(6)                   !/WORDS/
C       TEXT FOR SPEED, VOLUME, OCCUPANCY
C
      INTEGER UOCC1S(67)               !/D1S/
C       1-SEC. OCCUPANCY DATA FOR DOUBLE-LOOP DETECTORS
C
      INTEGER UPRNGE(113,2)            !/RANGE/
C       UPSTREAM RANGE FOR EACH DETECTOR
C
      INTEGER UPTIM(67)                !/ET/
C       UPSTREAM TIME FOR EACH DOUBLE-LOOP DETECTOR
C
      INTEGER UVOL1S(67)               !/D1S/
C       1-SEC. VOLUME DATA FOR EACH DOUBLE-LOOP DETECTOR
C
      INTEGER VOL1S(46)                !/D1S/
C       1-SEC. VOLUME DATA FOR EACH SINGLE-LOOP DETECTOR
C
      INTEGER VSPEED(67)               !/D1S/
C       1-SEC. VEHICLE SPEED DATA FOR EACH DOUBLE-LOOP DETECTOR
C
      INTEGER WEATHER(36)              !/WPV/
C       RECORD IN FILE 'WEATHER'
C
      LOGICAL WINSTON                  !/EXTRA/
C       TRUE IF EXTRA LANE FOR WINSTON CHURCHILL BLVD. DISPLAYED
C
```

```
        INTEGER XMTBUF(45)                 !/SGN1/
C         TRANSMIT BUFFER TO CMS
C
        INTEGER XREF(113)                  !/DINDX/
C         CROSS-REFERENCE TO CORRESPONDING DETECTOR DATA IN 'DATA30'
C
        INTEGER XREFTB(180)                !/DINDX/
C         CROSS-REFERENCE TABLE FOR DETECTOR NUMBERS ?
C
        INTEGER XTR(180)                   !/MDTRL/
C         ? TABLE
C
C
C
C
C       DATA STATEMENTS:
C
C
        DATA ALMBEEP /0/
        DATA ALMFLG /0/
        DATA AMODE /0/
        DATA APARM(1) /14,713,75,7125,1,250/
        DATA BUFSIZ /45/
        DATA CAP(1) /22*6000/
        DATA CHEK1(1) /10*0/, CHEK2(1) /10*0/
        DATA CNTADR(1) /65,68,8,12,20,24,32,40,40,48/
        DATA CNTON(1) /10*1/
        DATA CONTRL /0/
        DATA COUNT /1/
        DATA CTRMOD /4/
        DATA CYCOVR(1) /10*8/
        DATA DATA30(1) /718*0/
        DATA DFREQ /30/
        DATA DIST(1)
     *    / 780, 757, 974, 649, 990,1005, 837, 742, 729, 682
     *    , 920, 732, 727, 925, 749, 743, 789, 845, 819, 886/
        DATA DNRNGE(1,1) /201*0/
        DATA DOCC1S(1) /67*0/
        DATA DTIM1(1) /67*0/, DTIM2(1) /67*0/
        DATA DTOT /67/
        DATA DVUL1S(1) /67*0/
        DATA ERRARD /0/
        DATA ERRCNT(1) /10*0/
        DATA FT14D /0/
        DATA GCHN /14/
        DATA IDATA /0/
        DATA IMIN /3/
        DATA IMIN5 /0/
        DATA IMIN10 /0/
        DATA INCCNT /0/
        DATA INCEX /0/
        DATA INCFLAG(1) /21*0/
        DATA INCNT(1) /21*0/
        DATA INCOT /2/, INCST /2/, INCVT /2/
        DATA INCPRG(1) /21*0/
        DATA INCREC(1) /21*0/
        DATA INCSTAT(1) /21*0/
        DATA INCTV(1)
     *    /8,5,46,17, 8,5,46,17, 8,5,46,17, 8,5,46,17
     *    ,8,5,46,17, 8,5,46,17, 8,5,46,17, 8,5,46,17
     *    ,8,5,46,17, 8,5,46,17, 8,5,46,17, 8,5,46,17
     *    ,8,5,46,17, 8,5,46,17, 8,5,46,17, 8,5,46,17
     *    ,8,5,46,17, 8,5,46,17, 8,5,46,17, 8,5,46,17
     *    ,8,5,46,17/
        DATA K /'&&'/, K1 /'& '/
        DATA KSM /1/
        DATA KCNTSM /0/
        DATA KCNTD /0/
        DATA KCOUNT /0/
        DATA KDISP /1/
        DATA KINC /1/
        DATA KL30S /1/
        DATA KQCNT(1) /10*0/
        DATA KSTEP(1) /10*6/
        DATA KTHR /40/
        DATA KTIME /0/
        DATA KTLMT(1) /10*0/
        DATA LATST /0/
        DATA LDIST(1)
     *    /70,61,61,55,55,55,61,61,41,40
     *    ,37,37,55,55,55,61,61,61,64,64
     *    ,64,61,61,61,61,61,61,82,84,81
     *    ,61,61,59,60,61,62,61,58,61,61
     *    ,61,61,62,61,62,59,61,61,61,59
     *    ,61,61,55,53,56,62,61,62,61,63
     *   .64.56.60.59.58.60.59/
         DATA LIGHTS(1) /10*0/
         DATA LMAP /99/
         DATA LTCOND(1) /10*0/
         DATA LTSTAT(1) /10*0/
         DATA LVC1S(1) /67*0/
         DATA MAPNUM /1/
         DATA MAXCYC /5/
         DATA MAXOCC /25/
         DATA MAXSPD /350/
         DATA MAXVEH /4/
         DATA MCNT(1) /8.8.1.2.3.4.5.6.6.7/
         DATA MDMDET(1)
     *   /10*0.14.3*0.55.106.166.226.4*0.285.3*0
     *    .335.386.446.506.566.626.2*0.684.726.0.787
     *    .856.3*0.918.996.1058.5*0.1134.1176.1236.1296
     *    .1352.0.1376.1436.6*0.1496.1556.1612.3*0.1636
     *    .1696.1756/
         DATA METER(1) /10*0/
         DATA MODCYC(1) /10*0/
         DATA MODEM(1) /148*0/
         DATA MODEM1(1) /73*0/
         DATA MODEMT(1) /299*0/
         DATA MODNO(1)
     *   /8*0.4*1.4*2.3.4.2*0.4*5.4*6.7.8.9.10.4*11.12
     *    .13.14.0.4*15.16.3*0.4*17.4*18.19.20.6*0.21.22
     *    .23.0.4*24.25/
         DATA MSGID /-2/
         DATA MTLSGN(1) /2*0/
         DATA NALREC /1/
         DATA NBRAMP /0/
         DATA NDD /10/, NED /11/
         DATA NDETRC /0/
         DATA NDKEY /0/
         DATA NERROR(1) /73*0/
         DATA NMSGRX /0/, NMSGTX /0/
         DATA NOBEEP /0/
         DATA NPD /10/, NQD /13/
         DATA NRAMPS /10/
         DATA NSTNS /22/
         DATA NUMMDM /73/
         DATA NWORDS /26/
         DATA NWREC /1/
         DATA OCC /.FALSE./
         DATA OCC1S(1) /46*0/
         DATA OCCDBI(1) /21*0/, OCCUBI(1) /21*0/
         DATA P4FLG /0/
         DATA PFILE /7/
         DATA PR1ERR /0/, PR2ERR/0/, PR3ERR /0/, PR4ERR/0/, PR5ERR /0/
         DATA PROTOCOL /0/
         DATA PSPRT /600/
         DATA QIND(1) /10*0/
         DATA QLNTH(1) /10*0/
         DATA QOCC(1) /13*0/
         DATA QOCCLB(1) /10*450/, QOCCUB(1)/ 10*600/
         DATA QOVR(1) /10*0/
         DATA QWAIT(1) /10*0/
         DATA RAMCYC(1) /10*0/
         DATA RDWCD /1/
         DATA RQEW /15/
         DATA RWTEMP /9/
         DATA S1 /6/, S2 /4/
         DATA SGNADR(1) /1,2/
         DATA SGNSTAT(1) /2*0/
         DATA STDLN /76/
         DATA STIM1(1) /46*0/
         DATA STOT /46/
         DATA THRCP(1) /4*0/
         DATA THRMOL /675/
         DATA TIMER /0/
         DATA TSK0 /0/
         DATA TSK1 /0/
         DATA TSK2 /0/
         DATA TSK3 /0/
         DATA TT(1) /20*0/
         DATA TXT(1) /' S','PO',' V','OL',' O','CC'/
         DATA UOCC1S(1) /67*0/
         DATA UPRNGE(1,1) /226*0/
         DATA UPTIM(1) /67*0/
         DATA UVOL1S(1) /67*0/
         DATA VOL1S(1) /46*0/
         DATA VSPEED(1) /67*0/
         DATA WEATHER(1) /6*0,'W:',9*0,'P:',9*0,'V:',9*0/
         DATA XREF(1)
     *    / 3.13.23.34, 4.14.24.35.25, 5.15.36.45.46, 6.16
     *    ,37,38,26, 7,17,39,40, 8,18,41, 9,19,42,28,29
     *    ,10,20,43,44,30,31,21,22, 1,11,32, 2,12,33,27
     *    ,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28
     *    ,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44
     *    ,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60
     *    ,61,62,63,64,65,66,67,10,11,12, 7, 8, 9, 4, 5, 6, 1, 2, 3/
      DATA XREFTB(1)
     *   /513,516,  1,  3, 28, 31, 68, 91, 94,113,514,517,  2,  4, 29
     *    , 32, 69, 92, 95,114,519,520,  5,  6,  9, 35, 84, 97, 98,135
     *    ,136,515,518,  7,  8, 30, 33, 34, 70, 77, 93, 96,115,116, 36, 37
     *    ,528,530,532,522,524,526,508,510,512,502,504,506
     *    , 11, 13, 15, 17, 19, 21, 23, 25, 27, 39, 41, 43, 45, 47, 49, 51
     *    , 53, 55, 57, 59, 61, 63, 65, 67, 72, 74, 76, 79, 81, 83, 86, 88
     *    , 90,100,102,104,106,108,110,112,118,120,122,124
     *    ,126,128,130,132,134,138,140,142,144,146,148,527
     *    ,529,531,521,523,525,507,509,511,501,503,505
     *    , 10, 12, 14, 16, 18, 20, 22, 24, 26, 38, 40, 42, 44, 46, 48, 50
     *    , 52, 54, 56, 58, 60, 62, 64, 66, 71, 73, 75, 78, 80, 82, 85, 87
     *    , 89, 99,101,103,105,107,109,111,117,119,121
     *    ,123,125,127,129,131,133,137,139,141,143,145,147/
      DATA XTB(1)
     *   /  3, 13, 23, 34,  4, 14, 24, 35, 25,126, 59,127, 60,128, 61
     *    ,129, 62,130, 63,131, 64,132, 65,133, 66,134, 67
     *    ,  5, 15, 36, 45, 46,  6, 16, 37, 38, 26,135, 68,136, 69,137, 70
     *    ,138, 71,139, 72,140, 73,141, 74,142, 75,143, 76
     *    ,144, 77,145, 78,146, 79,147, 80,148, 81,149, 82
     *    ,  7, 17, 39, 40,150, 83,151, 84,152, 85
     *    ,153, 86,154, 87,155, 88, 27,156, 89,157, 90,158, 91
     *    ,  8, 18, 41,  9, 19, 42, 28, 29,159, 92,160, 93,161, 94
     *    ,162, 95,163, 96,164, 97,165, 98, 10, 20, 43, 44
     *    ,166, 99,167,100,168,101,169,102,170,103,171,104
     *    ,172,105,173,106,174,107, 30, 31,175,108,176,109
     *    ,177,110,178,111,179,112,180,113,123, 56,124, 57
     *    ,125, 58,120, 53,121, 54,122, 55, 21, 22,  1, 11, 32
     *    ,  2, 12, 33,117, 50,118, 51,119, 52
     *    ,114, 47,115, 48,116, 49/
C
      END
```

```
C
      OVERLAY OACCIDENT
      SUBROUTINE ACCIDENT
C
C
C FUNCTION : LOOP THROUGH THE STATIONS TO DETERMINE WHERE AN ACCIDENT
C            HAS OCCURED. THE LOGICAL VARIABLE ACC HAS BEEN SET TO .FALSE.
C              IF INCIDENT =1 ACC WILL BE REDEFINED AS .TRUE. INDICATING
C              AN ACCIDENT HAS BEEN DETECTED. A FLAG "AFLG" WILL BE SET TO TRUE
C
C
      COMMON/GEOM/STOT,DTOT,NRAMPS,NSTNS,CAP(22)
      COMMON/QEWDATA/QEW
      COMMON/INCID/ACC,ALOC,AFLG
C
      INTEGER QEW(512),ALOC(3)
      INTEGER STOT,DTOT,NRAMPS,NSTNS,CAP
      LOGICAL ACC(22),AFLG
C
C
C     LOOP TO FIND ACCIDENT  I2=INITIAL WORD FOR INCIDENT
C
      AFLG=.FALSE.
      I2=171
      DO 60 I=1,NSTNS
          ACC(I)=.FALSE.
          I2=I2-5
          IF (QEW(I2).NE.1) GO TO 60
          ACC(I)=.TRUE.
          AFLG=.TRUE.
60      CONTINUE
C
      RETURN
      END
```

```
C
      OVERLAY OALM30S
      SUBROUTINE ALM30S
C
      COMMON/SGN1/XMTBUF(45),RCVBUF(45),SGNADR(2)
      COMMON/SGN3/SGNSTAT(2),ALMFLG,KCNTD,P4FLG,AMODE
      COMMON/ALM1/APARM(6)
      COMMON/CTRL3/CNTADR(10),CSTAT(10),LTSTAT(10)
      COMMON/CTRL4/CHEK1(10),CHEK2(10),LIGHTS(10)
      COMMON/D30/DATA30(718)
      COMMON/GEOM/STOT,DTOT,NRAMPS,NSTNS,CAP(22)
      COMMON/DINDX/XREFTB(180),XREF(113)
      COMMON/NREC/KL30S,NWREC,KINC,KSM,NALREC,KDISP
      COMMON/CTRL2/CYCOVR(10),RAMCYC(10)
      COMMON/ALARM/NOBEEP,ALMBEEP
      COMMON/WKDAY/HMS(3),MDY(3)
C
      INTEGER ALMREC(14)
      INTEGER SSPD(22),DNOCC(67),UPOCC(67),DVOL(10)
      INTEGER XMTBUF,RCVBUF,SGNADR
      INTEGER SGNSTAT,ALMFLG,KCNTD,P4FLG,AMODE
      INTEGER APARM
      INTEGER CNTADR,CSTAT,LTSTAT
      INTEGER CHEK1,CHEK2,LIGHTS
      INTEGER DATA30
      INTEGER STOT,DTOT,NRAMPS,NSTNS,CAP
      INTEGER XREFTB,XREF
      INTEGER KL30S,NWREC,KINC,KSM,NALREC,KDISP
      INTEGER CYCOVR,RAMCYC
      INTEGER NOBEEP,ALMBEEP
      INTEGER HMS,MDY
      INTEGER I1,I2,J,ID,IOCC,IER,IBEEP,LNO
      INTEGER CDBIT,DTBIT,SUM,GRN,AMB,RD,BIT
C
      EQUIVALENCE (DNOCC(1),DATA30(275)),(UPOCC(1),DATA30(342))
      EQUIVALENCE (SSPD(1),DATA30(675)),(DVOL(1),DATA30(591))
C
C
C
C OPEN FILE
      CALL OPEN(8,"ALMREC",3,IER,28)
C
C PROGRAM ID AND CHECKING PERIOD
C
      ALMREC(13)=1 ;PROG. ID
      ALMREC(14)=30 ;CHECK PERIOD IN SEC
C
      ALMREC(1)=HMS(1)
      ALMREC(2)=HMS(2)
      ALMREC(3)=HMS(3) ;TIME IT FAILS
C
C
C CHECK DOUBLE-LOOP DETECTORS FOR MALFN IF STN SPEED GE. 50KM/H(14M/S)
C
      IBEEP=0
      DO 100 I=1,NSTNS
      J=NSTNS-I+1 ;STN NO
      IF(SSPD(J).LT.APARM(1))GOTO 100 ;STN SPEED<50KM/H,NO CHECK
      I1=3*I-2 ;INDEX TO LOCATE CORR. MAINLINE DET OCC
      I2=I1+2
      IF(J.LE.6)I2=I2+1 ;STN 6 HAS 4 LANES
      IF(J.LT.6)I1=I1+1
      LNO=0 ;INIT LANE NO
      DO 90 K=I1,I2
      LNO=LNO+1
      DO 92 II=1,2  ;1 FOR DOWN,,2 FOR UPSTREAM
      ID=STOT+K+(II-1)*DTOT ;INDEX TO LOCATE CORR DET ADDR
      IOCC=DNOCC(K) ;CORR DOWNSTR. OCC
      IF(II.EQ.2)IOCC=UPOCC(K) ;CORR UPSTR OCC
      IF(XREFTB(ID).GE.1000)GOTO 92 ;ERROR ALR. NOTED
      IF(IOCC.LE.APARM(2))GOTO 92 ;OCC LE 95%,OK
      ALMREC(5)=XREFTB(ID) ;REC DET ADD THAT FAILS
      XREFTB(ID)=XREFTB(ID)+1000 ;DET FAIL FLAG SET
      ALMREC(4)=1 ;ID FOR DET FAIL
      ALMREC(6)=J ;STN NO
      ALMREC(7)=LNO ;LANE NO
      ALMREC(8)=II ;UP OR DOWNSTREAM
      ALMREC(9)=1 ;OCC WRONG
      ALMREC(10)=0 ;NOT USED
      ALMREC(11)=1  ;TYPE OF DATA(OCC)
      ALMREC(12)=IOCC ;VALUE
      CALL WRITR(8,NALREC,ALMREC,1,IER)
      NALREC=NALREC+1
      IBEEP=1 ;ALARM FLAG SET
92    CONTINUE
```

```
90      CONTINUE
100     CONTINUE
C
C
C CHECK CONTROLLER FOR MALFN
C
        DO 700 I=1,NRAMPS
        CSTAT(I)=0
        IF(CHEK1(I).EQ.CHEK2(I))GOTO 700
        DO 710 BIT=8,15
        ID=3 ;DEV ID FOR C170
        IF(I.GE.3.AND.I.LE.7)ID=2 ;DEV ID FOR CR710
        IF(ID.EQ.2.AND.(BIT.EQ.8.OR.BIT.GE.14))GOTO 710 ;BITS9-13 CHECKED(710)
        DTBIT=0
        CDBIT=0
        IF(ITEST(CHEK1(I),BIT))DTBIT=1
        IF(ITEST(CHEK2(I),BIT))CDBIT=1
        IF(DTBIT.EQ.CDBIT)GOTO 710 ;ERROR NOT IN THIS BIT POSITION
        ALMREC(10)=BIT ;REC BIT POS
        ALMREC(4)=ID ;DEVICE ID
        ALMREC(5)=CNTADR(I) ;CONTROLLER ADDR
        ALMREC(6)=I ;CONT LOCATION
        ALMREC(7)=0 ;NOT USED
        ALMREC(8)=0
        ALMREC(9)=0
        ALMREC(11)=0
        ALMREC(12)=0
        CALL WRITR(8,NALREC,ALMREC,1,IER)
        NALREC=NALREC+1
        IBEEP=1;ALARM FLAG SET
710     CONTINUE
        CSTAT(I)=1 ;CONTROLLER FAIL FLAG SET
700     CONTINUE
C
C CHECK LIGHT STATUS
C
        DO 800 I=1,NRAMPS
        IF(LTSTAT(I).GE.3)GOTO 800 ;ERRROR ALR NOTED
        GRN=0
        AMB=0
        RD=0
        IF(ITEST(LIGHTS(I),10))GRN=2
        IF(ITEST(LIGHTS(I),9))AMB=3
        IF(ITEST(LIGHTS(I),8))RD=4
        SUM=GRN+AMB+RD
        IF(RAMCYC(I).NE.0)GOTO 900;RAMP IS METERED WITH NON GREEN
        IF(SUM.EQ.2)GOTO 820 ;NO ERROR
        ALMREC(11)=1 ;P.GREEN CYCLE
        GOTO 810 ;REC ERROR
900     IF(SUM.EQ.6.OR.SUM.EQ.9)GOTO 820 ;NO ERROR
        IF(UVOL(I).LE.0)GOTO 820 ;NO VEH THRU SIGNAL LAST 30 SECS
        ALMREC(11)=2 ;NORMAL CYCLE
810     ALMREC(4)=4 ;DEV ID
        ALMREC(5)=CNTADR(I)+1 ;DEVICE ADDR
        ALMREC(6)=I ;DEV LOCATION
        ALMREC(7)=0
        ALMREC(8)=0 ;NOT USED
        ALMREC(9)=SUM ;ERR CODE
        ALMREC(10)=0 ;NOT USED
        ALMREC(12)=0
        LTSTAT(I)=LTSTAT(I)+1
        IF(LTSTAT(I).LT.3)GOTO 840
        IBEEP=1 ;ALARM  FLAG SET
        WRITE(10,830)I,SUM ;3 CONSECUTIVE ERROR,NOTIFY OPERATOR
830     FORMAT(' ','*LIGHT FAIL CONT:',I2,5X,'CODE:',I2)
840     CALL WRITR(8,NALREC,ALMREC,1,IER)
        NALREC=NALREC+1
        GOTO 800
820     LTSTAT(I)=0
800     CONTINUE
C
C LOOK FOR SIGN MALFN: RECORD TO 'ALMREC' IF FAIL FLAG SET
C
        IF(ALMFLG.EQ.0)GOTO 400
        ALMFLG=0 ;MALFN ACK'ED.RESET FLAG
        ALMREC(4)=6 ;DEV ID
        ALMREC(5)=SGNADR(1) ;DEV ADDR
        ALMREC(6)=1 ;DEV LOCATION
        DO 410 I=7,12
410     ALMREC(I)=0 ;NOT USED
        CALL WRITR(8,NALREC,ALMREC,1,IER)
        NALREC=NALREC+1
C
C
400     IF(IBEEP.EQ.1)ALMBEEP=1 ;NOTIFY OPERATOR
```

```
CALL CLOSE(8,IER)
RETURN
END
```

```
C
        COMPILER NOSTACK
        OVERLAY OALMSM
        SUBROUTINE ALMSM
C
        COMMON/ALM1/APARM(6)
        COMMON/GEOM/STOT,DTOT,NRAMPS,NSTNS,CAP(22)
        COMMON/DINDX/XREFTB(180),XREF(113)
        COMMON/NREC/KL30S,NWREC,KINC,KSM,NALREC,KDISP
        COMMON/ALARM/NOBEEP,ALMBEEP
        COMMON/WKDAY/HMS(3),MDY(3)
        COMMON/TCNT/COUNT,KCNT5M,IMINS,KCOUNT
        COMMON/RDET/NPD,NOD,NED,NQD
C
        INTEGER ALMREC(14),DATA5M(448)
        INTEGER APARM
        INTEGER STOT,DTOT,NRAMPS,NSTNS,CAP
        INTEGER EXVOL(11)
        INTEGER XREFTB,XREF
        INTEGER KL30S,NWREC,KINC,KSM,NALREC,KDISP
        INTEGER NOBEEP,ALMBEEP
        INTEGER HMS,MDY
        INTEGER COUNT,KCNT5M,IMINS,KCOUNT
        INTEGER NPD,NOD,NED,NQD
        INTEGER IBEEP,M,IER,IDX,IDET1,IDET2,IDET3,IPOS
        INTEGER ICODE,J,I1,I2,LNO,ID
C
        DATA EXVOL(1) /11*0/
C
C
C
C
C GET 5-MIN DATA
C
        M=K5M-7
        CALL OPEN (8,"DATA5M",1,IER,2*64)
        CALL READR (8,M,DATA5M(1),7,IER)
        CALL CLOSE (8,IER)
C
C OPEN 'ALMREC' FILE
C
        CALL OPEN(8,"ALMREC",3,IER,2*14)
C
C
        ALMREC(13)=2 ;PROG ID
        ALMREC(1)=HMS(1)
        ALMREC(2)=HMS(2)
        ALMREC(3)=HMS(3)
        ALMREC(4)=1 ;DEV ID
        ALMREC(10)=0 ;NOT USED
        ALMREC(14)=300 ;CHECKING PERIOD IN SECS
        IBEEP=0
C
C ACC 15-MIN EXIT VOL
C
        IF(KCNT5M.GE.3)KCNT5M=0 ;RESET TIME COUNTS EVERY 15 MINS
        DO 80 I=1,NED
        IF(KCNT5M.EQ.0)EXVOL(I)=0
        IDX=I+NPD+NOD+3 ;INDEX FOR EXIT VOL
        IF(DATA5M(IDX).LT.0)EXVOL(I)=-1
80      IF(EXVOL(I).GE.0)EXVOL(I)=EXVOL(I)+DATA5M(IDX)
        KCNT5M=KCNT5M+1 ;5-MIN COUNTS
C
C CHECK SINGLE LOOP DETECTORS
C
        IDET1=NPD+NOD
        IDET2=IDET1+NED
        IDET3=IDET2+NQD
        DO 100 I=1,STOT
        IDX=I+STOT+3 ;OCC INDEX
        IF(XREFTB(I).GE.1000.OR.DATA5M(IDX).LT.0)GOTO 100 ;ERR ALR NOTED
        IF(I.LE.NPD)GOTO 110 ;PASSAGE DET
        IF(I.LE.IDET1)GOTO 120 ;DEMAND DET
        IF(I.LE.IDET2)GOTO 130 ;EXIT DET
        IF(I.LE.IDET3)GOTO 140 ;QUEUE DET
        ALMREC(7)=5 ;MAINLINE SINGLE-LOOP DET
        IPOS=I-IDET3
        GOTO 112
140     IPOS=I-IDET2 ;QUEUE DET
        ALMREC(7)=4
        GOTO 112
110     IPOS=1
        ALMREC(7)=1
112     ICODE=1 ;OCC ERR CODE
        IF(DATA5M(IDX).LT.APARM(3).OR.DATA5M(IDX).GT.APARM(4))GOTO 199
        IDX=I+3 ;VOL INDEX
        IF(DATASM(IDX).GE.APARM(5).AND.DATASM(IDX).LE.APARM(6))GOTO 100
        ICODE=2 ;VOL ERR CODE
        GOTO 199
120     ALMREC(7)=2
        IPOS=I-NPD ;DET LOC
        IF(DATASM(IDX).GE.APARM(3))GOTO 100
        ICODE=1 ;OCC ERR CODE
        GOTO 199
130     ALMREC(7)=3
        ICODE=1
        IPOS=I-IDET1
        IF(DATASM(IDX).GT.APARM(4))GOTO 194
        IF(KCNTSM.LT.3)GOTO 100 ;NOT 15-MINS YET,NO VOL CHECK
        IDX=I+3 ;VOL INDEX
        IF(EXVOL(IPOS).GE.APARM(5))GOTO 100
        ICODE=2
199     ALMREC(5)=XREFTB(I) ;DEV ADDR
        XREFTB(I)=XREFTB(I)+1000
        ALMREC(6)=IPOS+1000 ;DET LOC
        ALMREC(8)=0 ;NOT USED
        ALMREC(9)=ICODE ;ERR CODE
        ALMREC(11)=ICODE ;TYPE OF DATA
        ALMREC(12)=DATASM(IDX) ;VALUE
        CALL WRITR(8,NALREC,ALMREC,1,IER)
        NALREC=NALREC+1
        IBEEP=1 ;ALARM FLAG SET
100     CONTINUE
C
C CHECK MAINLINE DETECTORS
C
        DO 600 I=1,NSTNS
        J=NSTNS-I+1 ;STN NO
        I1=3*I-2
        I2=I1+2
        IF(J.LE.6)I2=I2+1 ;STN 6 HAS 4 LANES
        IF(J.LT.6)I1=I1+1
        LNO=0 ;INIT LANE NO
        DO 500 K=I1,I2
        LNO=LNO+1
        DO 400 II=1,2 ;1 FOR DOWN,,2 FOR UPSTREAM
        IDX=3+2*STOT+(II+1)*DTOT+K ;INDEX TO GET CORR MAINLINE OCC
        ID=STOT+(II-1)*DTOT+K ;INDEX TO LOC CORR DET NO
        IF(XREFTB(ID).GE.1000.OR.DATASM(IDX).LT.0)GOTO 400 ;ERR ALR NOTED
        ICODE=1 ;OCC ERR CODE
        IF(DATASM(IDX).LT.APARM(3).OR.DATASM(IDX).GT.APARM(4))GOTO 410
        IDX=IDX-2*DTOT ;MAINLINE VOL INDEX
        IF(DATASM(IDX).GE.APARM(5).AND.DATASM(IDX).LE.APARM(6))GOTO 400
        ICODE=2 ;VOL ERR CODE
410     ALMREC(5)=XREFTB(ID) ;DEV ADDR
        XREFTB(ID)=XREFTB(ID)+1000 ;DET ERR FLAG SET
        ALMREC(6)=J ;STN NO
        ALMREC(7)=LNO ;LANE NO
        ALMREC(8)=II ;UP OR DOWNSTR
        ALMREC(9)=ICODE ;ERR CODE
        ALMREC(11)=ICODE ;TYPE OF DATA
        ALMREC(12)=DATASM(IDX) ;VALUE
        CALL WRITR(8,NALREC,ALMREC,1,IER)
        NALREC=NALREC+1
        IBEEP=1
400     CONTINUE
500     CONTINUE
600     CONTINUE
        IF(IBEEP.EQ.1)ALMBEEP=1
        CALL CLOSE(8,IER)
C
        RETURN
        END
```

```
C
      OVERLAY OAMODM
      SUBROUTINE AMODM
C
      COMMON/MD/MODEMT(299),MODEM(148),MODEM1(73),NUMMDM
      COMMON/NREC/KL30S,NWREC,KINC,KSM,NALREC,KDISP
      COMMON/MONO/MODNO(73)
      COMMON/ALARM/NOBEEP,ALMBEEP
      COMMON/WKDAY/HMS(3),MDY(3)
C
      INTEGER MODEMT,MODEM,MODEM1,NUMMDM
      INTEGER KL30S,NWREC,KINC,KSM,NALREC,KDISP
      INTEGER MODNO
      INTEGER NOBEEP,ALMBEEP
      INTEGER HMS,MDY
      INTEGER ALMREC(14)
C
C WRITE OUT DATE & TIME INFORMATION
C
      WRITE(10,90)MDY,HMS
90    FORMAT(//I5,'/',I2,'/',I2,5X,I2,':',I2,':',I2//'>'Z)
C OPEN FILE
      CALL OPEN(8,"ALMREC",3,IER,28)
C
C PROGRAM ID AND CHECKING PERIOD
C
      ALMREC(13)=3 ;PROGRAM ID
      ALMREC(14)=600 ;CHECKING PERIOD IN SEC
C
      ALMREC(1)=HMS(1)
      ALMREC(2)=HMS(2)
      ALMREC(3)=HMS(3) ; TIME IT FAILS
      ALMREC(4)=5 ;DEVICE ID FOR MODEMS
C
C CHECK MODEMS FOR MALFUNCTION
C
      DO 100 I=1,NUMMDM
      IF(I.LE.8) GOTO 100 ;NOT USED
      IF(I.EQ.12.OR.I.EQ.19.OR.I.EQ.20.OR.I.EQ.24)GOTO 100 ;NOT USED
      IF(I.EQ.40.OR.I.EQ.46.OR.I.EQ.47.OR.I.EQ.48)GOTO 100; NOT USED
      IF(I.EQ.56.OR.(I.GE.59.AND.I.LE.64).OR.I.EQ.68)GOTO 100;NOT USED
      IF(MODEM(I).GE.10)GOTO 100; ERROR ALREADY DETECTED
      IF(MODEMT(3+I).LT.0)GOTO 110    ;ECHO TEST RESPONSE
      IF(MODEMT(151+I).GT.0)GOTO 110  ;SAMPLING COUNT RESPONSE
      MODEM(I)=0
      GOTO 100
110   MODEM(I)=MODEM(I)+1
      IF(I.EQ.37)TYPE 'SIGN MODEM MALFUNCTION'
      IF(MODEM(I).EQ.1)ALMBEEP=1
      IM1=I-1
      IQ1=IM1/8
      IQ2=IQ1/8
      ALMREC(5)=(IQ2*10+MOD(IQ1,8))*10+MOD(IM1,8) ;MODEM ADDR IN OCTAL NO
      ALMREC(6)=MODNO(I) ;MODEM NO (LOCATION)
      ALMREC(7)=0
      ALMREC(8)=0
      ALMREC(9)=1 ;ERROR CODE
      IF(MODEMT(151+I).GT.0)ALMREC(9)=2
      IF(MODEMT(151+I).GT.0.AND.MODEMT(3+I).LT.0)ALMREC(9)=3
      ALMREC(10)=0
      ALMREC(11)=0
      ALMREC(12)=MODEMT(151+I)
      CALL WRITR(8,NALREC,ALMREC,1,IER)
      NALREC=NALREC+1
100   CONTINUE
C
      CALL CLOSE(8,IER)
      RETURN
      END
```

```
C
      OVERLAY OBOX1
      SUBROUTINE BOX1
C
C
C FUNCTIONS - READS NUMBER OF MAINLINE STATIONS AND TOTAL NUMBER OF RAMP
C               AND EXIT CONTROLLERS FOR THIS MAP
C             - SETS COLOUR TO DRAW BOXES
C             - READS THE ACTUAL INITIAL ELEMENTS FOR MAINLINE STATION SPEED
C               AND RAMP VOLUME
C             - DISPLAYS BOXES IN GREEN
C
C     NLIGHTS = THE NUMBER OF CYCLE LENGTHS TO BE DISPLAYED FOR THIS MAP
C        CLEN = THE INITIAL WORD POSITION IN QEWDYN FOR CYCLE LENGTH
C       NPOLY = TOTAL NUMBER OF   POLYGONS TO BE DISPLAYED(NSTA+NCON)
C       NSTA  = NUMBER OF MAINLINE POLYGONS TO CONTAIN TEXTUAL DATA
C       NCON  = NUMBER OF RAMP & EXIT CONTROLLERS CONTAINING TEXTUAL DATA
C       IS = INITIAL WORD IN QEWDYN FOR SPEED AT THE STATION IN QUESTION
C       IV =                                  VOLUME
C       IO =                                 OCCUPANCY
C       RV =                               RAMP VOLUMES
C       RO =                             RAMP OCCUPANCIES
C
C
      COMMON/WORDS/NSTA.NCON.IS,IV,IO,RO,RV.TXT.K.K1
      COMMON/SCREEN/GCHN,PFILE,RWTEMP
      INTEGER NSTA,NCON.IS,IV,IO
      INTEGER RV,RO,TXT(6),GCHN,PFILE,RWTEMP,IDATA(39)
C
C     READ NUMBER OF RAMP CONTROLLERS FOR THIS DISPLAY
C
      READ(PFILE.500) NCON
500   FORMAT(I2)
      NPOLY=NSTA+NCON
C
C     SET COLOUR FOR TEXT BOXES
C
      WRITE(GCHN.600)
600   FORMAT(" ","ICOL C2 C0")
C
C     READ ACTUAL INITIAL SUBSCRIPTS FOR MAINLINE STATION SPEED
C     AND RAMP VOLUME
C
      READ(PFILE.700)IS,RV
700   FORMAT(2(I3.1X))
      IV=IS+1
      IO=IV+1
      RO=RV+1
C
C     DISPLAY MAINLINE RAMP & EXIT VECTOR BOXES
C
      DO 100 I=1.NPOLY
15    READ(PFILE.18) (IDATA(J).J=1,39)
      WRITE(GCHN.35) (IDATA(J).J=1,39)
      KK=ISHFT(IDATA(39).8)+46K
      IF(KK .EQ. K .OR. IDATA(37) .EQ. K1) GOTO 15
18    FORMAT(39A2)
35    FORMAT(" ".39A2)
100   CONTINUE
      RETURN
      END
```

```
C
      OVERLAY DBOX2
      SUBROUTINE BOX2
C
C
C   FUNCTION : TO DISPLAY THE MAINLINE AND RAMP STATION DATA
C     FOR ALL THE DISPLAYS EXCEPT STATION 15A ON MISS RD.
C
C     NSTA  = NUMBER OF MAINLINE POLYGONS TO CONTAIN TEXTUAL DATA
C     NCON  = NUMBER OF RAMP & EXIT CONTROLLERS CONTAINING TEXTUAL DATA
C     IS = INITIAL WORD IN QEWDYN FOR SPEED AT THE STATION IN QUESTION
C     IV =                                  VOLUME
C     IO =                                 OCCUPANCY
C     RV =                               RAMP VOLUMES
C     RO =                             RAMP OCCUPANCIES
C
C
      COMMON/WORDS/NSTA.NCON.IS.IV.IO.RO.RV.TXT.K.K1
      COMMON/QEWDATA/QEW
      COMMON/SCREEN/GCHN.PFILE.RQEW.RWTEMP
      INTEGER NSTA.NCON.IS.IV.IO
      INTEGER QEW(512).IDATA(39).RV.RO.TXT(6).GCHN.PFILE.RQEW.RWTEMP
55    FORMAT(6A2)
C
C     DISPLAY THE TEXTUAL DATA FOR THE MAINLINE STATIONS
C
C     SPEED
C
      DO 200 I=1.NSTA
      READ(PFILE.55) (IDATA(J),J=1,6)
      WRITE(GCHN.150)(IDATA(J).J=1.6).QEW(IS).TXT(1).TXT(2)
      IS=IS+5
C     VOLUME
      READ(PFILE.55)(IDATA(J),J=1,6)
      WRITE(GCHN.150)(IDATA(J).J=1.6).QEW(IV).TXT(3).TXT(4)
      IV=IV+5
C     OCCUPANCY
      READ(PFILE.55)(IDATA(J),J=1,6)
      WRITE(GCHN.150)(IDATA(J).J=1.6).QEW(IO).TXT(5).TXT(6)
      IO=IO+5
150   FORMAT(" ".6A2."!STR /".I3.2A2."/")
200   CONTINUE
C
C  DISPLAY RAMP & EXIT TEXTUAL DATA
C                 -SINCE MISS RD SCREWS THINGS UP REDUCE NCON BY 1
C
      IF(MAPNUM .EQ. 5) NCON=NCON-1
      DO 300 I=1.NCON
      READ(PFILE.55)(IDATA(J),J=1,6)
      WRITE(GCHN.150)(IDATA(J).J=1.6).QEW(RV).TXT(3).TXT(4)
      RV=RV+2
C
      READ(PFILE.55)(IDATA(J),J=1,6)
      WRITE(GCHN.150)(IDATA(J).J=1.6).QEW(RO).TXT(5).TXT(6)
      RO=RO+2
300   CONTINUE
      RETURN
      END
```

```
C
         OVERLAY OBOX3
         SUBROUTINE 20X3
C    FUNCTION: DISPLAY CYCLE TIME FOR ON RAMPS AS WELL AS
C        STATION DATA FOR STA 15A ON MISS RD.
C
C      NLIGHTS = THE NUMBER OF CYCLE LENGTHS TO BE DISPLAYED FOR THIS MAP
C         CLEN = THE INITIAL WORD POSITION IN QEWDYN FOR CYCLF LENGTH
C        NPOLY = TOTAL NUMBER OF   POLYGONS TO BE DISPLAYED(NSTA+NCON)
C        NSTA  = NUMBER OF MAINLINE POLYGONS TO CONTAIN TEXTUAL DATA
C        NCON  = NUMBER OF RAMP & EXIT CONTROLLERS CONTAINING TEXTUAL DATA
C        IS = INITIAL WORD IN QEWDYN FOR SPEED AT THE STATION IN QUESTION
C        IV =                                  VOLUME
C        IO =                                 OCCUPANCY
C        RV =                               RAMP VOLUMES
C        RO =                             RAMP OCCUPANCIES
C
C
         COMMON/WORDS/NSTA.NCON.IS.IV.IO.RO.RV.TXT,K,K1
         COMMON/QEWDATA/QEW
         COMMON/SCREEN/GCHN,PFILE,RQEW,RWTEMP
         INTEGER NSTA,NCON,IS,IV,IO
         INTEGER QEW(512),IDATA(39),RV,RO,TXT(6),GCHN,PFILE,RQEW,RWTEMP
         INTEGER NLIGHTS,CLEN
         IF(MAPNUM.EQ. 5) GOTO 1000     !IF MISS RD. HAS STA 15A
C
C        DISPLAY CYCLE LENGTH
C
1100     READ(PFILE,800)NLIGHTS,CLEN      !GET # OF CLENGTHS TO DISPLAY & INIT POSI
800      FORMAT(2I2)
         DO 850 I=1,NLIGHTS
         READ(PFILE,55)(IDATA(J),J=1,6)      !READ VECTOR POSITION
         I100=QEW(CLEN)/100
         IP=QEW(CLEN)-(I100*100)
         I10=IP/10
         I1=IP-(I10*10)
         WRITE(GCHN,900) (IDATA(J),J=1,6),I100,I10,I1
         CLEN=CLEN+5
850      CONTINUE
900      FORMAT(" ",6A2,"1STR/",2I1,".",I1,"SEC/")
         RETURN
C
C FOR STA 15A ON MISS RD
C
1000     IV=167
         IO=168
C
C        READ & DISPLAY MAINLINE STATION DATA
C
         READ(PFILE,55)(IDATA(J),J=1,6)
         WRITE(GCHN,150)(IDATA(J),J=1,6),QEW(IV),TXT(3),TXT(4)
C
C        READ CO-ORD FOR BOXES & DISPLAY TEXTUAL DATA
C
         READ(PFILE,55)(IDATA(J),J=1,6)
         WRITE(GCHN,150)(IDATA(J),J=1,6),QEW(IO),TXT(5),TXT(6)
         GOTO 1100
55       FORMAT(6A2)
150      FORMAT(" ",6A2,"STR/",I3,2A2,"/")
         END
```

```
C
      OVERLAY OCHQOR
      SUBROUTINE CHQOR
C
C FUNCTION: TO DETFRMINE IF THE RAMPS ARE IN A Q OVERRIDE CONDITION. IF SO
C           THEN TO WHAT DEGREE? THIS ROUTINE PASSES THESE CONDITIONS
C           THROUGH THE LOGICAL VARIABLES DESCRIBED BELOW.
C
C CALLER: TASK GMAP
C
C
C ARGUMENTS :
C             NOTIN(I) LOGICAL VARIABLE WHICH WILL BE PASSED AS FALSE IF THE
C                      RAMP INQUESTION IS NOT IN QUEUE O/R CONDITION.
C
C             INBL(10) LOGICAL VARIABLE TO PASS FALSE IF IN QUEUE O/R CONDITION
C                      BUT BELOW UPPER BOUND THRESHOLD VALUE.
C
C             INAB(10) LOGICAL VARIABLE TO PASS FALSE IF IN QUEUE O/R CONDITION
C                      BUT ABOVE UPPER BOUND THRESHOLD VALUE.
C
C
C     I INDICATES THE RAMPS FOR THE INTERCHANGE
C
C            1,2  CAWTHRA NB & SB
C            3,4  HWY 10 NB & SB
C            5,6  MISSISSAUGA NB & SB
C              7  SOUTH DOWN RD
C            8,9  WINSTON CHURCHILL NB & SB
C             10  FORD DR
C
C
      COMMON/GEOM/STOT,DTOT,NRAMPS,NSTNS,CAP(22)
      COMMON/Q01/QOVR(10),QIND(10)
      COMMON/Q04/QOCCLB(10),QOCCUB(10)
      COMMON/QEWDATA/QEW
      COMMON/RQOR/NOTIN,INBL,INAB
C
      INTEGER QOVR,QIND
      INTEGER QOCCLB,QOCCUB
      INTEGER STOT,DTOT,NRAMPS,NSTNS,CAP
      INTEGER QEW(512)
C
      LOGICAL NOTIN(10),INBL(10),INAB(10)
C
C
C
C
      J=10
      DO 150 I=1,NRAMPS
      NOTIN(I)=.TRUE.
      INAB(I)=.TRUE.
      INBL(I)=.TRUE.
      IF (QIND(I).NE.1) GO TO 40
      IOCC=QOCCUB(I)*10/75                ;CONVERT PULSES TO %
      IF (QEW(J)-IOCC) 100,50,60
40    NOTIN(I)=.FALSE.
50    INAB(I)=.FALSE.
60    INBL(I)=.FALSE.
100   J=J+5
150   CONTINUE
C
      RETURN
      END
```

```
C
      OVERLAY OCLOU
      SUBROUTINE CLOU
C
      COMMON/NREC/KL30S.NWREC.KINC.KSM.NALREC.KDISP
      COMMON/WKDAY/HMS(3).MOY(3)
      COMMON/INCA/INCTV(84).INCREC(21).INCFLAG(21).INCSTAT(21)
      COMMON/INCD/INCPRG(21).INCOT.INCVT.INCST
      COMMON/RDFIL/RDWCD.RSDVR(21)
C
      INTEGER KL30S.HMS.MOY.INCTV.INCREC.INCFLAG.INCSTAT
      INTEGER INCOT.INCVT.INCST.RDWCD.RSDVR
      INTEGER LNOCC(66).LNVOL(66).LNSPD(66).STNOCC(22).STNVOL(22).STNSPD(22)
      INTEGER DL.CL.PL.DNDL.DNCL.DNPL
      INTEGER MIN.SIGMA
      INTEGER RESDEV(26).DATAX(320)
      INTEGER STN.T.TREC.TOCC.TVOL.TSPD
      INTEGER DNOCC.DNVOL.DNSPD
C
C OPEN DISK FILE "DATAX" TO OBTAIN OCC.. VOL.. SPD. DATA AT TIME OF INCIDENT
C
      CALL OPEN (8.'DATAX'.1.IER.2*64)
      DO 20 STN=1.21
        IF(STN.EQ.3)GOTO 20;                        STN. 3 HAS NO DWNSTRM STN
        IF(INCSTAT(STN).EQ.INCPRG(STN))GOTO 20;     NO NEW INCIDENT HAS OCCURRED ; GO TO NEXT STATION
          T=1
C
C SET TREC(STARTING RECORD TO BE READ IN DATAX) AND READ CORRESPONDING LOGICAL RECORD OF "DATAX"
C
 61     TREC=(T-1)*5
        CALL READR(8.TREC.DATAX(1).5.IER)
C
C BREAK DATAX ARRAY DOWN INTO SIX SMALLER ARRAYS ISOLATING; OCC.. VOL.. SPD.. DATA FOR LANES AND STATIONS
C
        DO 21 I=1.66
          LNOCC(I)=DATAX(I)
         'LNVOL(I)=DATAX(66+I)
          LNSPD(I)=DATAX(132+I)
 21       CONTINUE
C
        DO 22 J=1.22
          STNOCC(J)=DATAX(198+J)
          STNVOL(J)=DATAX(220+J)
          STNSPD(J)=DATAX(242+J)
 22       CONTINUE
C
C CALCULATE ELEMENTS OF ARRAY CONTAINING LANES OF STATION (OF INCIDENT)
C
        PL=STN*3-2
        CL=STN*3-1
        DL=STN*3
C
C SET INDICES TO LOCATION OF STATION DOWNSTREAM FROM THE INCIDENT
C
        INCRMT=3
        IF(STN.EQ.3)INCRMT=6;                       STN #3 IS ON 403 THEREFORE STN #4 IS DWNSTRM FROM STN # 2
C
        DNPL=PL+INCRMT
        DNCL=CL+INCRMT
        DNDL=DL+INCRMT
C
C OCCUPANCY CLOU
C SELECT LANE WITH MIN. DOWNSTREAM OCC.
C
        TOCC=T+14
        IF(LNOCC(DNDL).LT.LNOCC(DNCL))GOTO 30
          IF(LNOCC(DNCL).LT.LNOCC(DNPL))GOTO 32;         YES - CENTER LANE
 30         IF(LNOCC(DNDL).LT.LNOCC(DNPL))GOTO 31;       YES - DRIVING LANE
              RESDEV(TOCC)=3;                           NO  - PASSING LANE
              MIN=DNPL
              GO TO 33
 31         RESDEV(TOCC)=1
            MIN=DNDL;                                     DRIVING LANE
            GO TO 33
 32       RESDEV(TOCC)=2;                                 CENTER LANE
          MIN=DNCL
C
C CALCULATE SIGMA VALUE FOR LANE - TEST AGAINST LANE INCIDENT OCC. THRESHOLD VALUE
C
 33     IF(STNOCC(STN+1).LE.0)GOTO 38;              CHECK TO PREVENT DIVISION BY ZERO
          SIGMA=((STNOCC(STN+1)-LNOCC(MIN))*10)/(STNOCC(STN+1))
          IF(SIGMA.GE.INCOT)GOTO 40;                  YES - LANE OF INCIDENT
C
C IF SIGMA TOO SMALL. SELECT LANE WITH MAX. UPSTREAM OCC.
C
```

```
  30       IF(LNOCC(DL).GT.LNOCC(CL))GOTO 35
             IF(LNOCC(CL).GT.LNOCC(PL))GOTO 37;              CENTER LANE
  35           IF(LNOCC(DL).GT.LNOCC(PL))GOTO 36;            DRIVING LANE
                 RESDEV(TOCC)=3;                                  PASSING LANE
                 GO TO 40
  36           RESDEV(TOCC)=1;                                    DRIVING LANE
               GO TO 40
  37         RESDEV(TOCC)=2;                                      CENTER LANE
C
C VOLUME CLDU
C SELECT LANE WITH MINIMUM VOLUME AT THE DOWNSTREAM STATION
C
  40       TVOL=T+18
           IF(LNVOL(DNDL).LT.LNVOL(DNCL))GOTO 41
             IF(LNVOL(DNCL).LT.LNVOL(DNPL))GOTO 43;          YES - CENTER LANE
  41           IF(LNVOL(DNDL).LT.LNVOL(DNPL))GOTO 42;        YES - DRIVING LANE
                 RESDEV(TVOL)=3;                             NO  - PASSING LANE
                 MIN=DNPL
                 GO TO 44
  42           RESDEV(TVOL)=1
               MIN=DNDL;                                          DRIVING LANE
               GO TO 44
  43         RESDEV(TVOL)=2;                                      CENTER LANE
             MIN=DNCL
C
C CAL. SIGMA - TEST AGAINST LANE INC. VOL. THRESHOLD
C
  44       IF(STNVOL(STN+1).LE.0)GOTO 48;                   TEST FOR DIVISION BY ZERO
             SIGMA=((STNVOL(STN+1)-LNVOL(MIN))*10)/(STNVOL(STN+1))
             IF(SIGMA.GE.INCVT)GOTO 50;                     YES - LANE OF INCIDENT
C
C IF SIGMA TOO SMALL , SELECT LANE WITH MINIMUM UPSTREAM VOL.
C
  48       IF(LNVOL(DL).LT.LNVOL(CL))GOTO 45
             IF(LNVOL(CL).LT.LNVOL(PL))GOTO 47;              CENTER LANE
  45           IF(LNVOL(DL).LT.LNVOL(PL))GOTO 46;            DRIVING LANE
                 RESDEV(TVOL)=3;                                  PASSING LANE
                 GO TO 50
  46           RESDEV(TVOL)=1;                                    DRIVING LANE
               GO TO 50
  47         RESDEV(TVOL)=2;                                      CENTER LANE
C
C SPEED CLDU
C SELECT LANE WITH MINIMUM UPSTREAM SPEED
C
  50       TSPD=T+22
           IF(LNSPD(DL).LT.LNSPD(CL))GOTO 51
             IF(LNSPD(CL).LT.LNSPD(PL))GOTO 53;              YES - CENTER LANE
  51           IF(LNSPD(DL).LT.LNSPD(PL))GOTO 52;            YES - DRIVING LANE
                 RESDEV(TSPD)=3;                             NO  - PASSING LANE
                 MIN=PL
                 GO TO 54
  52           RESDEV(TSPD)=1
               MIN=DL;                                            DRIVING LANE
               GO TO 54
  53         RESDEV(TSPD)=2;                                      CENTER LANE
             MIN=CL
C
C CAL. SIGMA - TEST AGAINST LANE INC. SPD THRESHOLD
C
  54       IF(STNSPD(STN).LE.0)GOTO 58
             SIGMA=((STNSPD(STN)-LNSPD(MIN))*10)/(STNSPD(STN))
             IF(SIGMA.GE.INCST)GOTO 60
C
C IF SIGMA TOO SMALL SELECT LANE WITH MAX. DWNSTRM SPEED
C
  58       IF(LNSPD(DNDL).GT.LNSPD(DNCL))GOTO 55
             IF(LNSPD(DNCL).GT.LNSPD(DNPL))GOTO 57;          CENTER LANE
  55           IF(LNSPD(DNDL).GT.LNSPD(DNPL))GOTO 56;        DRIVING LANE
                 RESDEV(TSPD)=3;                                  PASSING LANE
                 GO TO 60
  56           RESDEV(TSPD)=1;                                    DRIVING LANE
               GO TO 60
  57         RESDEV(TSPD)=2;                                      CENTER LANE
C
C REPEAT PROCEDURES USING PREVIOUS TIME SLICE 'T-1'
C INCREMENT 'T' , DECREMENT 'REC30' ,CHECK 'T' TO TEST IF THREE TIME SLICES HAVE BEEN TAKEN YET
C
  60       T=T+1
           IF(T.LE.3)GOTO 61
C
C WRITE "RESDEV" ARRAY TO 'RESDEV' DISK FILE TO PASS VOTE DATA TO VTLU ROUTINE
C
           CALL OPEN(3,'RESDEV',3,IER,2*26)
           CALL WRITR(3,NORCD,RESDEV(1),1,IER)
```

```
      CALL CLOSE(3,IER)
      NSUVN(STN)=NORCO
      NORCO=NORCO+1
C
   20 CONTINUE
      CALL CLOSE(8,IER)
      CALL DFILW('DATAX',IER);          "DATAX" IS A TEMPORARY FILE USED TO PASS DATA
C                                       BETWEEN ROUTINES; AFTER USE IT IS DELETED
      RETURN
      END
```

```
C
C       TASK COMCOM
C
C       A ONE-SECOND PERIODIC HP21MX TO NOVA 4/X
C          COMMUNICATION AND TRAFFIC DATA PROCESSING TASK.
C
C       LEGEND:
C          PROTOCOL #1 - RECEIVE DETECTOR DATA
C          PROTOCOL #2 - TRANSMIT RAMP CONTROL COMMANDS
C          PROTOCOL #3 - RECEIVE MODEM RESPONSE DATA
C          PROTOCOL #4 - TRANSMIT MESSAGE TO CMS
C          PROTOCOL #5 - RECEIVE MESSAGE ECHO-BACK FROM CMS
C
        COMMON/KLOCK/TIMER
        COMMON/TSKSYN/TSK0,TSK1,TSK2
        COMMON/COMM/DETECT(545),NDETRC,NOKEY
        COMMON/PROT/CONMSG(2),REPLY(2),PROTOCOL,MSGID,KTIME,PSPRT
        COMMON/ERRP/PR1ERR,PR2ERR,PR3ERR,PR4ERR,PR5ERR
        COMMON/MD/MODEMT(299),MODEM(148),MODEM1(73),NUMMOM
        COMMON/CTRL6/COMDOP(8),CNTON(10),NBRAMP
        COMMON/SGN1/XMTBUF(45),RCVBUF(45),SGNADR(2)
        COMMON/SGN2/NWORDS,BUFSIZ,NMSGTX,NMSGRX,MTLSGN(2)
        COMMON/SGN3/SGNSTAT(2),ALMFLG,KCNTD,P4FLG,AMODE
        COMMON/CNTFLG/NZERO2
C
        INTEGER MDMTMP(148)
        INTEGER TIMER
        INTEGER TSK0,TSK1,TSK2
        INTEGER DETECT, NDETRC, NOKEY
        INTEGER CONMSG,REPLY,PROTOCOL,MSGID,KTIME,PSPRT
        INTEGER PR1ERR,PR2ERR,PR3ERR,PR4ERR,PR5ERR
        INTEGER MODEMT,MODEM,MODEM1,NUMMOM
        INTEGER COMDOP,CNTON,NBRAMP
        INTEGER XMTBUF,RCVBUF,SGNADR
        INTEGER NWORDS,BUFSIZ,NMSGTX,NMSGRX,MTLSGN
        INTEGER SGNSTAT,ALMFLG,KCNTD,P4FLG,AMODE
        INTEGER NZERO2
C
        EQUIVALENCE (MDMTMP(1),MODEMT(4))
C
C
C
C
50      CONTINUE
        CALL REC (TIMER, MSGDTN)
        IF(PROTOCOL.LT.1) PROTOCOL=1
        GO TO (100,200,300,400,500),PROTOCOL
C
100     CONMSG(1)=1 ;PROTOCOL#1
        CONMSG(2)=545
        CALL BWRIT(CONMSG(1),2,IST) ;XMIT CONTROL MESSAGE
        CALL BREAD(REPLY(1),2,IST) ;RECEIVE REPLY FROM BDCSP
        IF (REPLY(2).NE.CONMSG(2))PR1ERR=PR1ERR+1
        IF (REPLY(2).NE.CONMSG(2))GO TO 100;ERROR-TRY AGAIN
        CALL BREAD(DETECT(1),545,IST) ;GET DETECTOR DATA FROM BDCSP
        IF (MSGID.EQ.32767)MSGID=-1 ;REINITIALIZE TO AVOID INTEGER OVERFLOW
        MSGID=MSGID+1 ;INC MESSAGE SEQUENCE NO
        PROTOCOL=0 ;PROTOCOL #1 IS COMPLETED
        IF (MSGID.LT.0)GO TO 900 ;IGNORE FIRST DETECT BUFFFR
C
C       CHECK IF DETECTOR DATA TO BE STORED
C
        IF (.NOT. (NDETRC .GT. 0) )  GO TO 190
C
C           WRITE DETECTOR DATA TO FILE
C
            CALL WRITR (6, NDETRC, DETECT(1), 1, IER)
            NDETRC = NDETRC + 1
C
C           CHECK IF 60 SEC. ELAPSED
C
            IF (.NOT. (NDETRC .GT. 60) )  GO TO 190
C
C               RETURN TO SUBR. 'T18A'
C
                CALL XMT (NOKEY, 1, $150)
                GO TO 190
C
C               ERROR IN XMT CALL
C
150             TYPE "ERROR IN TASK 'COMCOM': NOKEY =", NOKEY
                GO TO 190
C             END IF
C
```

```
C         END IF
190       CONTINUE
          CALL DATAIN
          CALL MODM1
          CALL RAMCON
C
          PROTOCOL=2
200       CONMSG(1)=2 ;PROT #2
          CONMSG(2)=8
          CALL BWRIT(CONMSG(1),2,IST)
          CALL BREAD(REPLY(1),2,IST) ;RECEIVE REPLY FROM BDCSP
          IF (REPLY(2).NE.CONMSG(2))PR2ERR=PR2ERR+1
          IF (REPLY(2).NE.CONMSG(2))GO TO 200
          CALL BWRIT(COMDOP(1),8,IST) ;XMT COMMAND TO BDCSP
          PROTOCOL=0 ;PROTOCOL #2 COMPLETED
          IF (P4FLG.EQ.0)GO TO 360
          IF (P4FLG.GT.1)GO TO 420
C
          PROTOCOL=4 ;PROT #4
400       CONMSG(1)=4
          CONMSG(2)=45
          CALL BWRIT(CONMSG(1),2,IST)
          CALL BREAD(REPLY(1),2,IST)
          IF (REPLY(2).NE.-2)GO TO 430
          AMODE=1
          PROTOCOL=0
          GO TO 570
430       CONTINUE
          IF (REPLY(2).NE.CONMSG(2))PR4ERR=PR4ERR+1
          IF (REPLY(2).NE.CONMSG(2))GO TO 400
          CALL BWRIT(XMTBUF(1),45,IST)
          PROTOCOL=0
420       P4FLG=P4FLG+1
          IF (P4FLG.LT.5)GO TO 360
C
          PROTOCOL=5
500       CONMSG(1)=5
          CONMSG(2)=45
          CALL BWRIT(CONMSG(1),2,IST)
          CALL BREAD(REPLY(1),2,IST)
          IF(REPLY(2).NE.-2)GO TO 510
          AMODE=1
          PROTOCOL=0
          GO TO 570
510       CONTINUE
          IF (REPLY(2).NE.CONMSG(2))PR5ERR=PR5ERR+1
          IF (REPLY(2).NE.CONMSG(2))GO TO 500
          CALL BREAD(RCVBUF(1),45,IST)
          NMSGRX=NMSGRX+1
          PROTOCOL=0
          P4FLG=0
C
570       CONTINUE
          CALL XMT(TSK0,1,$590)
          NZERO2=0
          GO TO 360
C
590       CONTINUE
          IF (NZERO2.EQ.0)
     *       TYPE "ERROR IN TASK 'COMCOM': FOR SUBR 'TP140'. ",
     *       "TSK0 = ", TSK0
          NZERO2= 1
          GO TO 360
C
360       IF (KTIME.LT.PSPRT)GO TO 900
          KTIME=0
C
          PROTOCOL=3
300       CONMSG(1)=3 ;PROT #3
          CONMSG(2)=148
          CALL BWRIT(CONMSG(1),2,IST) ;XMIT PROT #3 TO BDCSP
          CALL BREAD(REPLY(1),2,IST) ;RECEIVE REPLY FROM BDCSP
          IF (REPLY(2).EQ.-1)GO TO 800 ;ABORT THIS PROT
          IF (REPLY(2).NE.CONMSG(2))PR3ERR=PR3ERR+1
          IF (REPLY(2).NE.CONMSG(2))GO TO 300
          CALL BREAD(MDMTMP(1),148,IST) ;GET MODEM STATUS
800       PROTOCOL=0 ;PROT #3 COMPLETED
          GO TO 900
C
900       CONTINUE
          GO TO 50
          END
```

```
C
C       TASK CORCAS
C
C
C       A ONE-MINUTE PERIODIC CORRIDOR CONTROL AND
C         SURVEILLANCE TASK. FOR FUTURE USE.
C
C
C
C       SPECIFICATION STATEMENTS:
C
C
C       COMMON STATEMENTS:
C
        COMMON /TSKSYN/ TSK0.TSK1.TSK2.TSK3
C
C       DATA-TYPE STATEMENTS:
C
C                           INPUT VARIABLES
C
        INTEGER TSK0.TSK1.TSK2.TSK3
C
C                           INTERNAL VARIABLES
C
        INTEGER MO3
C
C
C
C
C       WAIT FOR XMT FROM SUBR 'DATAIN'
C
500     CONTINUE
        CALL REC (TSK3. MO3)
C
C       END OF ROUTINE
C
        GO TO 500
        END
```

```
C
      SUBROUTINE DATAIN
C
C
      COMMON/TSKRVN/TSK0,TSK1,TSK2,TSK3
      COMMON/GEOM/STOT,DTOT,NRAMPS,NSTNS,CAP(22)
      COMMON/D1S/VOL1S(46),OCC1S(46),DVOL1S(67),UVOL1S(67),DOCC1S(67),
     *  UOCC1S(67),VSPEED(67),LVC1S(67),LTCOND(10)
      COMMON/ET/STIM1(46),DTIM1(67),DTIM2(67),UPTIM(67)
      COMMON/LIMITS/MAXOCC,MAXSPD,IMIN,MAXVEH,STDLN,S1,S2
      COMMON/ST1S/LATST,ERHARD,IDATA
      COMMON/LOOPL/LDIST(67)
      COMMON/COMM/DETECT(545),NDETRC
      COMMON/CTRL7/ERRCNT(10),DFREQ
      COMMON/CTRL9/MCNT(10)
C
      INTEGER TSK0,TSK1,TSK2,TSK3
      INTEGER STOT,DTOT,NRAMPS,NSTNS,CAP
      INTEGER VOL1S,OCC1S,DVOL1S,UVOL1S,DOCC1S,
     *  UOCC1S,VSPEED,LVC1S,LTCOND
      INTEGER STIM1,DTIM1,DTIM2,UPTIM
      INTEGER MAXOCC,MAXSPD,IMIN,MAXVEH,STDLN,S1,S2
      INTEGER LATST,ERHARD,IDATA
      INTEGER UWAIT
      INTEGER LDIST
      INTEGER DETECT, NDETRC
      INTEGER ERRCNT,DFREQ
      INTEGER MCNT
C
      INTEGER IK,WEAVE,SPEED,LENGTH,MAXET1,IDX
C
C
C
C
C PROCESS SINGLE-LOOP DATA
C
      IK=8
      DO 100 I=1,STOT ;46 S/L DET'S
      IF(I.EQ.STOT)IK=269 ;DET #84
      IK=IK+2
      IF(IK.EQ.14.OR.IK.EQ.29.OR.IK.EQ.40.OR.IK.EQ.51)IK=IK+1
      IF(IK.EQ.60.OR.IK.EQ.77.OR.IK.EQ.86.OR.IK.EQ.91)IK=IK+1
      IF(IK.EQ.96)IK=IK+1
      CALL SLCHEK(DETECT(IK),DETECT(IK+1),STIM1(I),WEAVE,I)
      VOL1S(I)=VOL1S(I)+DETECT(IK)
      OCC1S(I)=OCC1S(I)+DETECT(IK+1)
100   CONTINUE
C
C PROCESS DOUBLE-LOOP DATA
C
      IJ=STOT
      IK=105
      DO 200 I=1,DTOT
      IK=IK+5
      IF(IK.EQ.269)IK=IK+5 ;DUMMY
      IF(IK.EQ.125.OR.IK.EQ.141.OR.IK.EQ.157.OR.IK.EQ.173)IK=IK+1
      IF(IK.EQ.189.OR.IK.EQ.205.OR.IK.EQ.221.OR.IK.EQ.237)IK=IK+1
      IF(IK.EQ.253.OR.IK.EQ.274.OR.IK.EQ.290.OR.IK.EQ.306)IK=IK+1
      IF(IK.EQ.327.OR.IK.EQ.343.OR.IK.EQ.359.OR.IK.EQ.375)IK=IK+1
      IF(IK.EQ.391.OR.IK.EQ.407.OR.IK.EQ.423.OR.IK.EQ.439)IK=IK+1
      IF(IK.EQ.455)IK=IK+1
      IJ=IJ+1
      WEAVE=0
      LATST=0
      UWAIT=0
      CALL SLCHEK(DETECT(IK),DETECT(IK+1),UPTIM(I),WEAVE,IJ)
      CALL DLCHEK(DETECT(IK+2),DETECT(IK+3),DETECT(IK+4),DTIM1(I),
    *DTIM2(I),WEAVE,UWAIT,I)
      DVOL1S(I)=DVOL1S(I)+DETECT(IK+2) ;ACC D. VOL
      DOCC1S(I)=DOCC1S(I)+DETECT(IK+3) ;ACC D. OCC
      UVOL1S(I)=UVOL1S(I)+DETECT(IK) ;ACC UP VOL
      UOCC1S(I)=UOCC1S(I)+DETECT(IK+1) ;ACC UP OCC
      IF(LATST.NE.0)GOTO 220 ;IGNORE SPEED & LENGTH CALCULATIONS
      IF(DETECT(IK+2).EQ.0)GOTO 200 ;VOL=0,NOT TO COMPUTE SPEED & LENG
      DTIM2(I)=DTIM2(I)/DETECT(IK+2) ;AVG EL TIME 2
      IF(DTIM2(I).LT.IMIN)DTIM2(I)=IMIN
      SPEED=LDIST(I)*25/DTIM2(I) ;SPEED IN M/SEC*10
      IF(SPEED.LE.0)SPEED=10 ;1M/S
      IF(SPEED.GT.MAXSPD)SPEED=MAXSPD
      LENGTH=STDLN ;BY DEFAULT IT IS A SHORT VEH(M*10)
      DTIM1(I)=DTIM1(I)/DETECT(IK+2) ;AVG EL TIME 1
      MAXET1=32760/SPEED ;MAX ALLOWABLE ELAPSED TIME 1
      IF(DTIM1(I).LE.MAXET1)LENGTH=(SPEED*DTIM1(I))/25-18
      IF(LENGTH.GT.STDLN)LVC1S(I)=LVC1S(I)+DETECT(IK+2)
      VSPEED(I)=(S1*VSPEED(I)+S2*SPEED)/10 ;M/S*10
220   DTIM1(I)=0
```

```
        DTIM2(I)=0
200     CONTINUE
C
        DO 300 I=1,NRAMPS
        IF(I.EQ.2.OR.I.EQ.9)GOTO 300
        IDX=MCNT(I)
        IF(IDX.EQ.4.OR.IDX.EQ.6)GOTO 310 !2 RAMPS/CONTROLLER
        LTCOND(I)=LTCOND(I).OR.DETECT(IDX)
        GOTO 300
310     K=I !N.B. RAMP
        IF(ITEST(DETECT(IDX),6))K=I+1 !S/B RAMP
        LTCOND(K)=LTCOND(K).OR.DETECT(IDX)
300     CONTINUE
C
C       INCREMENT 30 SEC. COUNTER
C
        IDATA=IDATA+1
C
C       IF 1 SEC. ELAPSED, THEN READY TASK 'CORCAS'
C
        IF (.NOT. (IDATA.EQ.1))  GO TO 410
        CALL XMT (TSK3, 1, $405)
        GO TO 999
405     TYPE "IN SUBR 'DATAIN', XMT ERROR: TSK3 =", TSK3
        GO TO 999
C
C       IF 30 SEC. ELAPSED, THEN READY TASK 'TRANSF'
C
410     IF (.NOT. (MOD(IDATA,DFREQ).EQ.0))  GO TO 999
        IF (IDATA.EQ.2*DFREQ)
     *    IDATA=0
        CALL NXFER
        CALL XMT (TSK1, 1, $415)
        GO TO 999
415     TYPE "IN SUBR 'DATAIN', XMT ERROR: TSK1 =", TSK1
        GO TO 999
C
C       END OF ROUTINE
C
999     RETURN
        END
```

```
      OVERLAY ODATST4
      SUBROUTINE DATSTR
      COMMON/NREC/RL305,NNREC,KINC,KSM,NALREC,KDISP
      COMMON/AKDAT/HMS(3),MDT(3)
      COMMON/INCA/INCTV(84),INCREC(21),INCFLAG(21),INCSTAT(21)

      COMMON/INCD/INCPRG(21),INCOT,INCVT,INCST

      INTEGER RL305,HMS,MDT,INCTV,INCREC,INCFLAG,INCSTAT
      INTEGER INCPRG,INCOT,INCVT,INCST
      INTEGER DATAX(264)
      INTEGER STN,T,I,TREC
      INTEGER DT305(768),REC30
      INTEGER DNOCC,DNVOL,DNSPD
C CREATE DISK FILE "DATAX" TO EXCHANGE DATA WITH CLOU ROUTINE

      CALL CFILW('DATAX',2,IER)

C UTILIZE INCSTAT ARRAY TO DETERMINE IF/AND WHERE AN INCIDENT OCCURRED

      STN=0
20    STN=STN+1
        IF(STN.GT.21)GOTO 999
        IF(STN.EQ.3)GOTO 20;                      STATION THREE HAS NO DOWNSTREAM STATION
C DETERMINE WHETHER OR NOT A NEW INCIDENT HAS BEEN DETECTED

        IF(INCSTAT(STN).EQ.0)INCPRG(STN)=0;       EITHER NO NEW INCIDENT OR AN INCIDENT HAS CLEARED
          IF(INCSTAT(STN).EQ.INCPRG(STN))GOTO 20; NO NEW INCIDENT
C OBTAIN PRECEEDING 1 MIN. LOGICAL RECORD OF DATA30 FILE

      REC30=RL305-36
      T=1
      CALL OPEN(3,'DATA30',1,IER,2*64)
61    CALL READR(3,REC30,DT305(1),12,IER)
C EXTRACT , LANE OCCUPANCY ,VOLUME ,AND SPEED DATA

      DNOCC=361;                                  LAST ELEMENT = DOWNSTREAM OCCUPANCY
      DNVOL=707;                                  LAST ELEMENT = DOWNSTREAM VOLUME
      DNSPD=475;                                  LAST ELEMENT = LANE SPEEDS
      DO 22 I=1,66
C EXTRACT LANE OCCUPANCY DATA - STORE IN DATAX(1-66)

        IF(DNOCC.NE.323)GOTO 23
          DNOCC=DNOCC-1;                          IGNORE FOURTH LANE OF STATION SIX

23      DATAX(I)=DT305(DNOCC)
        IF(DATAX(I).LT.0)DATAX(I)=DT305(DNOCC+67);  IN THE EVENT OF DOWNSTREAM DETECTOR ERROR USE
                                                    UPSTREAM DETECTION DATA
        DNOCC=DNOCC-1;                              DECREMENT INDEX
C EXTRACT LANE VOL. DATA - STORE IN DATAX(67-132)

        IF(DNVOL.NE.189)GOTO 24
          DNVOL=DNVOL-1
C

24      DATAX(66+I)=DT305(DNVOL)
        IF(DATAX(66+I).LT.0)DATAX(66+I)=DT305(DNVOL+67)

        DNVOL=DNVOL-1
C EXTRACT LANE SPEED DATA - STORE IN DATAX(133-198)

        IF(DNSPD.EQ.457)DNSPD=DNSPD-1
        DATAX(132+I)=DT305(DNSPD)
C
        DNSPD=DNSPD-1
C
22      CONTINUE
C ISOLATE AVERAGE STN. OCC.VOL.SPD DATA

      DO 25 J=1,22
        DATAX(198+J)=DT305(542+J)
        DATAX(220+J)=DT305(630+J)
        DATAX(242+J)=DT305(674+J)
25      CONTINUE
C WRITE OCC. , VOL. , SPD. DATA TO DISK FILE "DATAX" FOR USE IN CLOU
```

```
C
          TREC=(T-1)*5
          CALL OPEN(8,'DATAX',3,IER,2*64)
          CALL WRITR(8,TREC,DATAX(1),5,IER)
          CALL CLOSE(8,IER)
C
C REPEAT PROCEDURE WITH PREVIOUS TIME SLICE
C USE LOGICAL RECORD OF "DATA30" FROM 30 SEC. EARLIER
C
          T=T+1
          REC30=REC30-12
          IF(T.LE.3)GOTO 61
          CALL CLOSE(3,IER)
C
 999    RETURN
        END
```

```
C
        OVERLAY ODETECTOR
        SUBROUTINE DETECTOR
C
C    FUNCTION: TO DISPLAY MAINLINE DETECTOR STATIONS WHITE ON BLACK ----- IF
C         AN ACCIDENT IS DETECTED AT A STATION THE DISPLAY IS BLACK ON WHITE
C    LACC = A LOGICAL VARIABLE TO INDICATE THE ACCIDENT STATUS OF THE LAST STA.
C
C
        COMMON/INCID/ACC,ALOC,AFLG
        COMMON/SCREEN/GCHN,PFILE,RQEW,RWTEMP
        COMMON/GEOM/STOT,DTOT,NRAMPS,NSTNS,CAP(22)
        LOGICAL ACC(22),LACC,AFLG
        INTEGER GCHN,PFTLE,RQEW,RWTEMP,ALOC(3),IDATA(39)
        INTEGER STOT,DTOT,NRAMPS,NSTNS,CAP
C
C
C
        WRITE(GCHN,50)
50      FORMAT(" ","!COL C0 C7")
        LACC=.FALSE.
        DO 100 I=1,NSTNS
        IF(ACC(I) .AND. LACC) GOTO 75
        IF(.NOT. ACC(I) .AND. LACC) WRITE(GCHN,250)
        IF(ACC(I) .AND. .NOT. LACC) WRITE(GCHN,200)
75      READ(PFILE,18) (IDATA(J),J=1,39)
        WRITE(GCHN,35) (IDATA(J),J=1,39)
        LACC=ACC(I)
100     CONTINUE
C
18      FORMAT(39A2)
35      FORMAT(" ",39A2)
200     FORMAT(" ","!COL C7 C0")
250     FORMAT(" ","!COL C0 C7")
C
        RETURN
        END
```

```
      OVERLAY ODTSMAP
      SUBROUTINE DISMAP
C
C
C FUNCTIONS - READS POLYGON FILE TO OBTAIN INITIAL ELEMENT(+9) FOR OCCUPANCY
C                 ON PASSING,CENTRE AND DRIVING LANES.
C               - READS THE NUMBER OF MAINLINE STATIONS IN THE INTERCHANGE MAP.
C               - DISPLAYS HEADING,DATE AND TIME FOR ALL INTERCHANGE MAPS
C
C
C          IODL,IOCL,IOPL,ISOL,ISCL,ISPL ARE VARIABLE NAMES FOR THE
C          WORDS CONTAINING THE OCCUPANCY & SPEED OF THE DRIVING,
C          CENTRE AND PASSING LANES.
C
C       I =  THE DETECTOR STATION NUMBER
C       NDP = THE NUMBER OF DETECTOR POLYGONS IN THE FILE
C       NSTA = # OF MAINLINE STATIONS IN DISPLAY.
      
      COMMON/GRAPH/MAPNUM,LMAP
      COMMON/QEWDATA/QEW
      COMMON/SCREEN/GCHN,PFILE,RQEW,RWTEMP
      COMMON/OPTA/ISOL,ISCL,ISPL
      COMMON/OPTB/IODL,IOCL,IOPL
      COMMON/EXTRA/WINSTON
      COMMON/WORDS/NSTA,NCON,IS,IV,IO,RO,RV,TXT,K,K1
      COMMON/OCCRM/OCC,RMETER
      INTEGER GCHN,PFILE,RQEW,RWTEMP
      INTEGER QEW(512),LMAP,MAPNUM,IDATA(39)
      LOGICAL WINSTON
      INTEGER NSTA,NCON,IS,IV,IO,RO,RV,TXT(6),K,K1
      LOGICAL RMETER(10),OCC
      WINSTON=.FALSE.
C
C
C     READ DATA FILE TO OBTAIN INITIAL SUBSCRIPTS (+9) FOR OCCUPANCY
C     ON THE DRIVING,CENTRE AND PASSING LANES
      
      READ(PFILE,45)IODL,IOCL,IOPL
45    FORMAT(3(I3,1X))
      ISOL=IODL+1
      ISCL=IOCL+1
      ISPL=IOPL+1
C
C
C     READ FILE TO DETERMINE # OF MAINLINE STATIONS IN FILE
C
      READ(PFILE,50)NSTA
50    FORMAT(I1)
C
C
C     READ AND PLACE DISPLAY HEADING(WITH COLOUR CRITERIA)
C             -DATE AND
C             -TIME
C
      READ(PFILE,18) (IDATA(J),J=1,39)
      WRITE(GCHN,35) (IDATA(J),J=1,39)
C
C
C     BECAUSE OF THE CONTENT OF MISS. RD. THE DATE AND TIME MUST BE PLACED
C     ELSEWHERE WITHIN THE DISPLAY
C
      IF(MAPNUM .EQ. 5) GOTO 75
C
C
C     IF COLOUR CRITERIA IS OCCUPANCY : PLACE "(OCC)"
C
      IF(OCC) WRITE(GCHN,55)
55    FORMAT(" ","!VEC 100 423!STR/(OCC)/")
C
C
C     IF COLOUR CRITERIA IS SPEED : PLACE "(SPD)"
C
      IF (.NOT. OCC) WRITE(GCHN,60)
60    FORMAT(" ","!VEC 100 423!STR/(SPD)/")
      WRITE(GCHN,65)(QEW(I),I=1,3)
65    FORMAT(" ","!VEC 146 423!STR/DATE:",3I3,"/")
      WRITE(GCHN,70)(QEW(I),I=4,6)
70    FORMAT(" ","!VEC 144 407!STR/TIME:",3I3,"/")
      RETURN
C
C
C     PLACEMENT OF DATE AND TIME FOR MISS. RD.
C
75    IF(OCC) WRITE(GCHN,90)
      IF(.NOT. OCC) WRITE(GCHN,95)
90    FORMAT(" ","!VEC 145 422!STR/(OCC)/")
95    FORMAT(" ","!VEC 145 422!STR/(SPD)/")
      WRITE(GCHN,80) (QEW(I),I=1,3)
      WRITE(GCHN,85) (QEW(I),I=4,6)
80    FORMAT(" ","!VEC 10 151!STR/DATE:"3I3,"/")
85    FORMAT(" ","!VEC 10 129!STR/TIME:"3I3,"/")
C
```

```
18        FORMAT(39A2)
35        FORMAT(" ",39A2)
          RETURN
          END
```

```
C
      OVERLAY ODIS1
      SUBROUTINE DIS1
C
      DIMENSION QEWDYN(512)
      DIMENSION IDNO(10)
      DIMENSION VOL15A(2),OCC15A(2)
      DIMENSION PDVOL(10),PDOCC(10),DDVOL(10),DDOCC(10)
      DIMENSION QDVOL(13),QDOCC(13),EDVOL(11),EDOCC(11)
      DIMENSION DNVOL(67),DNOCC(67),LNSPD(67)
C
      COMMON/WKDAY/HMS(3),MDY(3)
      COMMON/D30/DATA30(718)
      COMMON/NWREC/KL30S,NWREC,KINC,K5M,NALREC,KDISP
      COMMON/TCNT/COUNT,KCNT5M,IMINS,KCOUNT
      COMMON/GEOM/STOT,DTOT,NRAMPS,NSTNS,CAP(22)
      COMMON/RDET/NPD,NDD,NED,NQD
C
      INTEGER QEWDYN
      INTEGER IDNO
      INTEGER VOL15A,OCC15A
      INTEGER PDVOL,PDOCC,DDVOL,DDOCC
      INTEGER QDVOL,QDOCC,EDVOL,EDOCC
      INTEGER DNVOL,DNOCC,LNSPD
      INTEGER HMS,MDY
      INTEGER DATA30
      INTEGER KL30S,NWREC,KINC,K5M,NALREC,KDISP
      INTEGER COUNT,KCNT5M,IMINS,KCOUNT
      INTEGER STOT,DTOT,NRAMPS,NSTNS,CAP
      INTEGER NPD,NDD,NED,NQD
      INTEGER J,IJ1,IJ2,NOQ,NOE,GOOD1
      INTEGER K,K1,K2,K3,K4,IER
C
      EQUIVALENCE (VOL15A(1),DATA30(93)),(OCC15A(1),DATA30(139))
      EQUIVALENCE (PDVOL(1),DATA30(49)),(DDVOL(1),DATA30(59))
      EQUIVALENCE (EDVOL(1),DATA30(69)),(QDVOL(1),DATA30(80))
      EQUIVALENCE (PDOCC(1),DATA30(95)),(DDOCC(1),DATA30(105))
      EQUIVALENCE (EDOCC(1),DATA30(115)),(QDOCC(1),DATA30(126))
      EQUIVALENCE (DNVOL(1),DATA30(141)),(DNOCC(1),DATA30(275))
      EQUIVALENCE (LNSPD(1),DATA30(409))
C
C THIS PROGRAM UPDATES 1-MIN RAMP DET AND MAINLINE LANE DATA
C FOR THE GRAPHIC FILE
C
C NO OF W-DET(MSD),NO OF EXIT DET(LSD)
C
      IDNO(1)=10
      IDNO(2)=12
      IDNO(3)=12
      IDNO(4)=11
      IDNO(5)=10
      IDNO(6)=21
      IDNO(7)=21
      IDNO(8)=10
      IDNO(9)=12
      IDNO(10)=22
C
C     OPEN FILE
C
      CALL OPEN (3, 'QEWDYN', 2, IER, 128)
C
C     CHECK IF 30 SEC. OR 60 SEC. CALL
C
      KCOUNT = KCOUNT + 1
      IF (.NOT. (MOD(KCOUNT,2) .EQ. 1))  GO TO 20
C
C       THEN 30 SEC. CALL => RE-INITIALIZE QEW BUFFER TO ZERO
C
          DO 10  I = 1, 512
10            QEWDYN(I) = 0
          GO TO 30
C
C       ELSE 60 SEC. CALL => READ EXISTING QEW BUFFER
C
20        CONTINUE
          CALL READR (3, KDISP, QEWDYN(1), 8, IER)
          GO TO 30
C
C       END IF
C
30    CONTINUE
C
C UPDATE DATE AND TIME INFOMATION
C
      QEWDYN(1)=MDY(3)
```

```
        QEWDYN(2)=MDY(1)
        QEWDYN(3)=MDY(2)
        QEWDYN(4)=HMS(1)
        QEWDYN(5)=HMS(2)
        QEWDYN(6)=HMS(3)
C
C
C STN15A VOL AND OCC
C
        J=7 ;BEG POINTER FOR TEMP WORKING BUFFER TO GET 30-SEC DATA
        QEWDYN(J)=VOL15A(1)+VOL15A(2) ;STN15A VOL
        QEWDYN(J+1)=OCC15A(1)+OCC15A(2) ;STN15A OCC IN PULSES
        IF(VOL15A(1).GE.0.AND.VOL15A(2).GE.0)GOTO 40;BOTH DETS OK
        IF(VOL15A(1).GE.0.OR.VOL15A(2).GE.0)GOTO 35 ;ONLY 1 DET WORKING
        QEWDYN(J)=-1
        QEWDYN(J+1)=-1
        GOTO 40
35      GOOD1=2
        IF(VOL15A(2).LT.0)GOOD1=1
        QEWDYN(J)=VOL15A(GOOD1)*2
        QEWDYN(J+1)=OCC15A(GOOD1)*2
C
C RAMP DETECTOR 30-SEC VOL AND OCC
C
40      J=J+2
        IJ1=0
        IJ2=0
        DO 50 I=1,NRAMPS
        NOQ=IDNO(I)/10 ;NO OF Q-DET FOR EACH RAMP
        NOE=MOD(IDNO(I),10) ;NO OF EXIT DET FOR EACH RAMP
        QEWDYN(J)=PDVOL(I) ;PASSAGE DET VOL
        QEWDYN(J+1)=PDOCC(I) ;PASSAGE DET OCC
        QEWDYN(J+2)=DDVOL(I) ;DEMAND DET VOL
        QEWDYN(J+3)=DDOCC(I) ;DEMAND DET OCC
        J=J+4
        DO 52 K=1,NOQ
        IJ1=IJ1+1 ;Q-DET INDEX
        QEWDYN(J)=QDVOL(IJ1)
        QEWDYN(J+1)=QDOCC(IJ1)
        J=J+2
52      CONTINUE
        IF(NOE.EQ.0)GOTO 50
        DO 54 K=1,NOE
        IJ2=IJ2+1 ;EXIT DET INDEX
        QEWDYN(J)=EDVOL(IJ2)
        QEWDYN(J+1)=EDOCC(IJ2)
        J=J+2
54      CONTINUE
50      CONTINUE
C
        CALL WRITR(3,KDISP,QEWDYN,8,IER)
        CALL CLOSE(3,IER)
C
        RETURN
        END
```

```
C
      OVERLAY ODIS2
      SUBROUTINE DIS2
C
      DIMENSION DMPREC(8)
      DIMENSION QEWDYN(512),CYCLES(50)
      DIMENSION SSPD(22),SVOL1M(22),SOCC1M(22)
C
      COMMON/SGN2/NWORDS,BUFSIZ,NMSGTX,NMSGRX,MTLSGN(2)
      COMMON/Q02/QWAIT(10),QLNTH(10)
      COMMON/D30/DATA30(718)
      COMMON/NREC/KL30S,NWREC,KINC,KSM,NALREC,KDISP
      COMMON/GEOM/STOT,DTOT,NRAMPS,NSTNS,CAP(22)
      COMMON/CTRL1/CONTRL,MAXCYC,METER(10),MODCYC(10)
      COMMON/CTRL2/CYCOVR(10),RAMCYC(10)
      COMMON/QOC/QOCC(13)
      COMMON/INCA/INCTV(84),INCREC(21),INCFLAG(21),INCSTAT(21)
      COMMON/RDFIL/RDRCD,RSOVR(21)
C
      INTEGER DMPREC
      INTEGER QEWDYN,CYCLES
      INTEGER SSPD,SVOL1M,SOCC1M
      INTEGER NWORDS,BUFSIZ,NMSGTX,NMSGRX,MTLSGN
      INTEGER QWAIT,QLNTH
      INTEGER DATA30
      INTEGER KL30S,NWREC,KINC,KSM,NALREC,KDISP
      INTEGER STOT,DTOT,NRAMPS,NSTNS,CAP
      INTEGER CONTRL,MAXCYC,METER,MODCYC
      INTEGER CYCOVR,RAMCYC
      INTEGER QOCC
      INTEGER INCTV,INCREC,INCFLAG,INCSTAT
      INTEGER RDRCD,RSOVR
C
      EQUIVALENCE (SOCC1M(1),DATA30(587)),(SVOL1M(1),DATA30(609))
      EQUIVALENCE (SSPD(1),DATA30(675))
C
C THIS PROGRAM INTEGRATES RAMP CONTROL DATA AND MAINLINE STN 1-MIN DATA
C TO THE 1-MIN DATA CREATED IN DIS1.FR TO COMPLETE THE GRAPHIC FILE
C
C OPEN FILES
      CALL OPEN(3,"CYCLES",1,IER,2*50) ;CYCLE LNTH TABLE
      CALL READR(3,1,CYCLES(1),1,IER)
      CALL CLOSE(3,IER)
C
      CALL OPEN(3,"QEWDYN",2,IER,2*64)
      CALL READR(3,KDISP,QEWDYN(1),8,IER)
C
C UPDATE MAINLINE CONTROL MODE,CYCLE LENGTH,RAMP WAITING TIME
C AND SMOOTHED Q-OCCUPANCY
C
      L=0
      DO 10 I=1,NRAMPS
      J=(I-1)*5+7
      QEWDYN(J)=MODCYC(I)
      QEWDYN(J+2)=QWAIT(I)
      QEWDYN(J+4)=0 ;RESERVED
      QEWDYN(J+1)=0
      K=(I-1)*MAXCYC+RAMCYC(I)
      IF(RAMCYC(I).GT.0.AND.RAMCYC(I).LE.MAXCYC)QEWDYN(J+1)=CYCLES(K)
      IF(RAMCYC(I).EQ.6)QEWDYN(J+1)=-999
      L=L+1
      IF(I.EQ.6.OR.I.EQ.7.OR.I.EQ.10)GOTO 12 ;RAMPS WITH 2 Q-DETS
      QEWDYN(J+3)=QOCC(L) ;SMOOTHED Q-OCC
      IF(QOCC(L).GT.0)QEWDYN(J+3)=QOCC(L)*2/15 ;IN %
      GOTO 10
12    QEWDYN(J+3)=MAX0(QOCC(L),QOCC(L+1))
      IF(QEWDYN(J+3).GT.0)QEWDYN(J+3)=QEWDYN(J+3)*2/15 ;IN %
      L=L+1
10    CONTINUE
C
C CAPACITY,SPEED,VOL,OCC AND INCIDENT STATUS
C
      DO 20 I=1,NSTNS
      J=(I-1)*5+NRAMPS*5+7
      K=NSTNS-I+1 ;STN NO
      QEWDYN(J)=CAP(K) ;CAPACITY
      QEWDYN(J+1)=SSPD(K)*18/5 ;SPEED IN KM/H
      IF(SSPD(K).LT.0)QEWDYN(J+1)=-1
      QEWDYN(J+2)=SVOL1M(K) ;1-MIN STN VOL
      QEWDYN(J+3)=SOCC1M(K)/45 ;1-MIN STN OCC IN %
      IF(K.EQ.6)QEWDYN(J+3)=SOCC1M(K)/60 ;STN #6 AN EXTRA (FOUR LANES TOTAL) LANE
      IF(SOCC1M(K).LT.0)QEWDYN(J+3)=-1
      QEWDYN(J+4)=0 ;INC STATUS CALCULATIONS
      IF(K.EQ.3.OR.K.EQ.22)GOTO 20 ;STNS 3 AND 22 HAVE NO DOWNSTR. STN
      IF(K.GE.4.AND.INCSTAT(K).GT.0)QEWDYN(J+4)=1 ;DOWNSTR NO
      IF(K.GE.3)GOTO 20
      IF(K.EQ.2.AND.INCSTAT(K+1).GT.0)QEWDYN(J+4)=1 ;FOR STN 2
      IF(K.EQ.1.AND.INCSTAT(K).GT.0)QEWDYN(J+4)=1
      IF(K.EQ.1.AND.INCSTAT(K+1).GT.0)QEWDYN(J+4)=1
20    CONTINUE
C
C
      CALL WRITR(3,KDISP,QEWDYN(1),8,IER)
      CALL CLOSE(3,IER)
      KDISP=KDISP+8
C
C
C
      DMPREC(1)=KL30S
      DMPREC(2)=NWREC
      DMPREC(3)=KINC
      DMPREC(4)=KSM
      DMPREC(5)=NALREC
      DMPREC(6)=KDISP
      DMPREC(7)=NMSGTX
      DMPREC(8)=RDRCD
C
      CALL OPEN(3,"DMPREC",3,IER,2*8)
      CALL WRITR(3,1,DMPREC(1),1,IER)
      CALL CLOSE(3,IER)
C
      RETURN
      END
```

```
C
      SUBROUTINE DLCHEK(VOL,ET1,ET2,AEL1,AEL2,WVE,TWOSEC,IJ)
      COMMON/LIMITS/MAXOCC,MAXSPD,IMIN,MAXVEH,STDLN,S1,S2
C
      COMMON/ST1S/LATST,ERHARD
      COMMON/RANGE/UPRNGE(113,2),DNRNGE(67,3)
      INTEGER MAXOCC,MAXSPD,IMIN,MAXVEH,STDLN,S1,S2
C
      INTEGER LATST,ERHARD
      INTEGER UPRNGE,DNRNGE
      INTEGER VOL,ET1,ET2,AEL1,AEL2,WVE,TWOSEC,IJ,IROW
C
C
C
      IROW=1
      IF(VOL.GT.MAXVEH.OR.VOL.LT.0)GOTO 120
      IF(ET1.LT.0.OR.ET2.LT.0)GOTO 140
      IF(ET1.GT.MAXOCC)ET1=MAXOCC
      IF(ET2.GT.MAXOCC)ET2=MAXOCC
      IF(WVE.EQ.1.AND.VOL.EQ.0.AND.ET1.EQ.0)GOTO 125
      IF(WVE.EQ.1.AND.VOL.GT.0.AND.ET1.GT.0.AND.ET2.EQ.0)GOTO 125
      IF(WVE.EQ.0.AND.VOL.EQ.0.AND.ET1.EQ.0)TWOSEC=TWOSEC+1
      IF(VOL.GT.0.OR.ET1.GT.0)TWOSEC=0
      IF(TWOSEC.GE.2)GOTO 125
      AEL1=AEL1+ET1 ;ACC EL TIME 1
      IF(VOL.EQ.0)GOTO 130
      IROW=2
      IF(AEL1.LT.(VOL*IMIN))GOTO 120
130   AEL2=AEL2+ET2 ;ACC EL TIME 2
      IF(VOL.EQ.0)GO TO 999
      IF(AEL2.GE.(VOL*IMIN))GO TO 999
      LATST=1 ;FLAG TO IND NOT TO COMPUTE SPEED
      IROW=3
120   DNRNGE(IJ,IROW)=DNRNGE(IJ,IROW)+1
140   ERHARD=ERHARD+1 ;INC ERROR COUNTS
      IF(LATST.EQ.1)GOTO 135 ;DO NOT SET DNSTREAM VALUES TO 0
125   VOL=0
      ET1=0
      AEL1=0
135   ET2=0
      AEL2=0
      TWOSEC=0
C
999   RETURN
      END
```

```
C
        OVERLAY ODYS1
        SUBROUTINE DYS1
C
        DIMENSION QEWDYN(512)
        DIMENSION IDNO(10)
        DIMENSION VOL15A(2),OCC15A(2)
        DIMENSION PDVOL(10),PDOCC(10),DDVOL(10),DDOCC(10)
        DIMENSION QDVOL(13),QDOCC(13),EDVOL(11),EDOCC(11)
        DIMENSION DNVOL(67),DNOCC(67),LNSPD(67)
C
        COMMON/WKDAY/HMS(3),MDY(3)
        COMMON/D30/DATA30(718)
        COMMON/NREC/KL30S,NWREC,KINC,K5M,NALREC,KDISP
        COMMUN/TCNT/COUNT,KCNT5M,IMINS,KCOUNT
        COMMUN/GEOM/STOT,DTOT,NRAMPS,NSTNS,CAP(22)
        COMMON/RDET/NPD,NUD,NED,NQD
C
        INTEGER QEWDYN
        INTEGER IDNO
        INTEGER VOL15A,OCC15A
        INTEGER PDVOL,PUOCC,DDVOL,DDOCC
        INTEGER QDVOL,QDUCC,EDVOL,EDOCC
        INTEGER DNVOL,DNOCC,LNSPD
        INTEGER HMS,MDY
        INTEGER DATA30
        INTEGER KL30S,NWREC,KINC,K5M,NALREC,KDISP
        INTEGER COUNT,KCNT5M,IMINS,KCOUNT
        INTEGER STOT,DTOT,NRAMPS,NSTNS,CAP
        INTEGER NPD,NUD,NED,NQD
        INTEGER J,IJ1,IJ2,NUQ,NOE,GOOD1
        INTEGER K,K1,K2,K3,K4,IER
C
        EQUIVALENCE (VOL15A(1),DATA30(93)),(OCC15A(1),DATA30(139))
        EQUIVALENCE (PDVOL(1),DATA30(49)),(DDVOL(1),DATA30(59))
        EQUIVALENCE (EDVOL(1),DATA30(69)),(QUVOL(1),DATA30(80))
        EQUIVALENCE (PDOCC(1),DATA30(95)),(DDOCC(1),DATA30(105))
        EQUIVALENCE (EDUCC(1),DATA30(115)),(QDOCC(1),DATA30(126))
        EQUIVALENCE (DNVOL(1),DATA30(141)),(DNOCC(1),DATA30(275))
        EQUIVALENCE (LNSPD(1),DATA30(409))
C
C THIS PROGRAM UPDATES 1-MIN RAMP DET AND MAINLINE LANE DATA
C FOR THE GRAPHIC FILE
C
C OPEN FILE
        CALL OPEN(3,"QEWDYN",2,IER,128)
        CALL REAUR(3,KDISP,QEWDYN(1),8,IER)
C
        K1=NRAMPS*5+NSTNS*5+6
        K2=(NPU+NDD+NQD+NED)*2+2
        K3=K1+K2+1
C
        IF(MOU(KCOUNT,2).EQ.0)GOTO 90 ;END OF MINUTE
C
        DO 60 I=1,K2
        QEWDYN(K1+I)=QEWDYN(I+6)
60      QEWDYN(I+6)=0
C
C 30-SEC MAINLINE LANE DATA
C
        DO 70 I=1,DTOT
        QEWDYN(K3)=DNVOL(I)
        QEWDYN(K3+1)=DNUCC(I)
        QEWDYN(K3+2)=LNSPU(I)
        K3=K3+3
70      CONTINUE
C
C WRITE 30-SEC DATA TO FILE
C
        GOTO 900
C
C GET 1-MIN DATA
C
90      IF(QEWDYN(K1+1).LT.0.OR.QEWDYN(7).LT.0)GOTO 80
        QEWDYN(K1+1)=QEWDYN(K1+1)+QEWDYN(7) ;STN15A VOL
        QEWDYN(K1+2)=(QEWDYN(K1+2)+QEWDYN(8))/30 ;STN15A OCC IN %
        GOTO 200
80      QEWDYN(K1+1)=-1
        QEWDYN(K1+2)=-1
C 1-MIN RAMP DETECTOR VOL AND OCC
200     DO 300 I=3,K2
        IF(QEWDYN(K1+I).LT.0.OR.QEWDYN(I+6).LT.0)GOTO 310
        QEWDYN(K1+I)=QEWDYN(K1+I)+QEWDYN(I+6)
        K4=MUD(I,2)
        IF(K4.EQ.0)QEWDYN(K1+I)=QEWDYN(K1+I)/15 ;OCC IN %
        GOTO 300
310     QEWDYN(K1+I)=-1
300     CONTINUE
C
C 1-MIN MAINLINE LANE DATA(VOL,OCC,SPEED)
C
        DO 500 I=1,DTOT
        IF(QEWDYN(K3).LT.0.OR.DNVOL(I).LT.0)GOTO 510
        QEWDYN(K3)=QEWDYN(K3)+DNVOL(I)
        QEWDYN(K3+1)=(QEWDYN(K3+1)+DNOCC(I))/15 !OCC IN %
        IF(QEWDYN(K3+2).LT.0.OR.LNSPD(I).LT.0)GOTO 520
        QEWDYN(K3+2)=(QEWDYN(K3+2)+LNSPD(I))*9/5 !AVG SPD IN KM/H
        GOTO 530
510     QEWDYN(K3)=-1
        QEWDYN(K3+1)=-1
520     QEWDYN(K3+2)=-1
530     K3=K3+3
500     CONTINUE
C
900     CALL WRITR(3,KDISP,QEWDYN,8,IER)
        CALL CLOSE(3,IER)
C
        RETURN
        END
```

```
C
      OVERLAY OFACC
      SUBROUTINE FACC
C
C
      COMMON/GEOM/STOT,DTOT,NRAMPS,NSTNS,CAP(22)
      COMMON/INCID/ACC,ALOC,AFLG
C
      INTEGER STOT,DTOT,NRAMPS,NSTNS,CAP
      LOGICAL ACC(22),AFLG
      INTEGER ALOC(3)
C
C     LOCATE FIRST 3 ACCIDENT LOCATIONS
C
      J=1
      DO 100 I=1,NSTNS
      IF(ACC(I)) ALOC(J)=I
      IF(ACC(I)) J=J+1
      IF(J .GE. 4) GO TO 999      !RECORD FIRST 3 ACC LOCATIONS ONLY
100   CONTINUE
C
999   RETURN
      END
      OVERLAY OFLASH
      SUBROUTINE FLASH
C
C FUNCTION : TO COLLECT THE FIRST 3 ACCIDENT LOCATION POLYGONS AND WRITE THEM
C              INTO A TEMPORARY FILE WHICH IS LATER DISPLAYED USING "LOOP"
C
C
      COMMON/GEOM/STOT,DTOT,NRAMPS,NSTNS,CAP(22)
      COMMON/SCREEN/GCHN,PFILE,ROEW,RWTEMP
      COMMON/INCID/ACC,ALOC,AFLG
      COMMON/NACC/KCNT
      COMMON/WORDS/NSTA,NCON,IS,IV,IO,RO,RV,TXT,K,K1
C
      INTEGER STOT,DTOT,NRAMPS,NSTNS,CAP
      INTEGER NSTA,NCON,IS,IV,IO,RO,RV,TXT(6),K,K1
      INTEGER IDATA(39)
      INTEGER GCHN,PFILE,ROEW,RWTEMP,ALOC(3)
      LOGICAL ACC(22),AFLG
C
C
      CALL CFILW("TEMPFILE",2,IER)
      CALL OPEN(RWTEMP,"TEMPFILE",2,IER,2*39)
      REWIND PFILE
      KCNT=0
C
C     TEST FOR LOCATION OF FIRST ACCIDENT
C
      IAL = ALOC(1)
      IF ( (IAL.LT.1) .OR. ( IAL.GT.3) ) GO TO 200
      GO TO (300,400,500), IAL
C
300   DO 325 I=1,2
325   READ(PFILE,18) (IDATA(L),L=1,39)
      GOTO 800
400   DO 425 I=1,4
425   READ(PFILE,18) (IDATA(L),L=1,39)
      GOTO 800
500   DO 510 I=1,5
510   READ(PFILE,18) (IDATA(L),L=1,39)
800   READ(PFILE,18) (IDATA(L),L=1,39)
18    FORMAT (39A2)
      WRITE(RWTEMP,35) (IDATA(L),L=1,39)
35    FORMAT (' ',39A2)
      KK=ISHFT(IDATA(39),8)+000046K
      IF(KK .EQ. K .OR. IDATA(37) .EQ. K1) GOTO 800;CHECK FOR 4027 CONT.
      KCNT=KCNT+1
      DO 540 I=2,3
      IF(ALOC(I) .EQ. 2) GOTO 530
      IF(ALOC(I) .EQ. 3 .AND. ALOC(I-1) .EQ. 2) GOTO 530
      IF(ALOC(I) .EQ. 3 .AND. ALOC(I-1) .EQ. 1) GOTO 525
      GOTO 550
525   READ(PFILE,18) (IDATA(L),L=1,39)
530   READ(PFILE,18) (IDATA(L),L=1,39)
      WRITE(RWTEMP,35) (IDATA(L),L=1,39)
      KK=ISHFT(IDATA(39),8)+46K
      IF(KK .EQ. K .OR. IDATA(37) .EQ. K1) GOTO 530
      KCNT=KCNT+1
540   CONTINUE
550   IF(KCNT .GE. 3) GOTO 1000        ;ONLY ALLOW FIRST 3 ACC LOCATIONS
      REWIND PFILE
200   DO 700 I=4,NSTNS
      IF(.NOT. ACC(I)) GOTO 700
      IF(KCNT .GE. 3) GOTO 1000
      NREC=I+3
      DO 600 J=1,NREC
      READ(PFILE,18) (IDATA(L),L=1,39)
600   CONTINUE
C
C     THIS EXTRA READ STMT AND CONTINUATION CHECK IS PROVIDED FOR
C     FUTURE POLYGONS WHICH MAY CONTAIN A 4027 CONTINUATION.
C
900   READ(PFILE,18) (IDATA(J),J=1,39)
      WRITE(RWTEMP,35) (IDATA(J),J=1,39)
      KK=ISHFT(IDATA(39),8)+46K
      IF(KK .EQ. K .OR. IDATA(37) .EQ. K1) GOTO 900
      KCNT=KCNT+1
      REWIND PFILE
700   CONTINUE
C
1000  RETURN
      END
```

```
C
C       TASK GMAP
C
C       A ONE-MINUTE PERIODIC TRAFFIC STATUS DISPLAY TASK.
C         USING TEKTRONIX 4027 GRAPHICS TERMINAL
C
C
C ALL THE DATA TO BE DISPLAYED IS CONTAINED IN A FILE OF TEKTRONIX 4027 COMMANDS
C THESE POLYGONS ARE COLOURED ACCORDING TO EITHER THE OCCUPANCY OR SPEED DATA.
C
        EXTERNAL OREGEN,OCHQOR,OACCIDENT,OGSPD,OGOCC
        EXTERNAL ORAMPS,ODETECTOR,OSPD1,OSPD2,OIOC1,OIOC2
        EXTERNAL OLOOP,OBOX1,OBOX2,OBOX3
        EXTERNAL OFLASH,OFACC,ODISMAP,ORDISMAP
C
        COMMON/QFWDATA/QEW
        COMMON/GEOM/STOT,DTOT,NRAMPS,NSTNS,CAP(22)
        COMMON/GRAPH/MAPNUM,LMAP
        COMMON/CTRL1/CONTRL,MAXCYC,METER(10),MODCYC(10)
        COMMON/SCREEN/GCMN,PFILE,RQEW,RWTEMP
        COMMON/TSKSYN/TSK0,TSK1,TSK2,TSK3
        COMMON/INCID/ACC,ALOC,AFLG
        COMMON/OCCRM/OCC,RMETER
        COMMON/WORDS/NSTA,NCON,IS,IV,IO,RO,RV,TXT,K,K1
        COMMON/OPTA/ISOL,ISCL,ISPL
        COMMON/OPTB/IOOL,IOCL,IOPL
C
        INTEGER QEW(512)
        INTEGER STOT,DTOT,NRAMPS,NSTNS,CAP
        INTEGER MAPNUM,LMAP
        INTEGER CONTRL,MAXCYC,METER,MODCYC
        INTEGER GCMN,PFILE,RQEW,RWTEMP
        INTEGER TSK0,TSK1,TSK2,TSK3
        INTEGER ALOC(3)
        INTEGER NSTA,NCON,IS,IV,IO,RO,RV,TXT(6),K,K1
        INTEGER ISOL,ISCL,ISPL
        INTEGER IOOL,IOCL,IOPL
C
        LOGICAL ACC(22),AFLG
        LOGICAL OCC,RMETER(10)
C
C
C       INTERNAL VARIABLES:
C
        INTEGER I,IDATA(39),IER,K60M,MO2
C
C
C
C       INITIALIZE 60-MINUTE COUNTER
C
        K60M=0
C
C       TASK IS READIED BY TASK 'TRANSF'
C
600     CONTINUE
        CALL REC (TSK2, MO2)
        IF (MAPNUM .LT. 1)  GO TO 600
C
C       READ QEWDYN DATA FILE
C
        CALL FOVLD(1,OREGEN,0,IER)
        CALL REGEN
        CALL FOVRL(OREGEN,IER)
C
C       CHECK QUEUE OVERRIDE CONDITIONS ON RAMPS
C
        CALL FOVLD(1,OCHQOR,0,IER)
        CALL CHQOR
        CALL FOVRL(OCHQOR,IER)
C
C       CHECK RAMP METERING
C
        DO 50 I=1,NRAMPS
        RMETER(I)=.TRUE.
        IF(METER(I) .EQ. 0) RMETER(I)=.FALSE.   !NO RAMP METERING
50      CONTINUE
C
C       CHECK FOR ACCIDENTS
C
        CALL FOVLD(1,OACCIDENT,0,IER)
        CALL ACCIDENT
        CALL FOVRL(OACCIDENT,IER)
C
C       CHECK TO ERASE SCREEN
```

```
C
        IF ( (MAPNUM.NE.LMAP) .OR. (MOD(K60M,60).EQ.0) )
     *    WRITE(GCHN,500)
500     FORMAT(" !WOR 33!GRA 1 33")
        LMAP=MAPNUM
        K60M=K60M+1
C
C       OPEN POLYGON FILES ON CHANNEL 7(PFILE)
C
        IF(MAPNUM .EQ. 1) CALL OPEN(PFILE,"QEWPOLY",1,IER,2*39)
        IF(MAPNUM .EQ. 2) CALL OPEN(PFILE,"FORDPOLY",1,IER,2*39)
        IF(MAPNUM .EQ. 3) CALL OPEN(PFILE,"KINPOLY",1,IER,2*39)
        IF(MAPNUM .EQ. 4) CALL OPEN(PFILE,"ERINPOLY",1,IER,2*39)
        IF(MAPNUM .EQ. 5) CALL OPEN(PFILE,"MISSPOLY",1,IER,2*39)
        IF(MAPNUM .EQ. 6) CALL OPEN(PFILE,"HWYPOLY",1,IER,2*39)
        IF(MAPNUM .EQ. 7) CALL OPEN(PFILE,"CAMPOLY",1,IER,2*39)
        IF (IER .NE. 1)
     *    TYPE "PFILE OPEN IER =", IER
        GO TO(1,2,2,2,2,2,2),MAPNUM
C
C
C  ***   M A I N   Q E W   D I S P L A Y   ***
C
C
C
C
C       READ AND PLACE STRING HEADING
C
1       CONTINUE
        READ(PFILE.18) (IDATA(I).I=1.39)
18      FORMAT(39A2)
        WRITE(GCHN.35) (IDATA(I).I=1.39)
35      FORMAT(" ",39A2)
        IF(OCC) WRITE(GCHN.5500)
5500    FORMAT(" ","!RVEC 120.0!STR/(OCC)/")
        IF(.NOT. OCC) WRITE(GCHN.6000)
6000    FORMAT(" ","!RVEC 120.0!STR/(SPD)/")
C
C       DISPLAY CURRENT TIME AND DATE FROM QEWDYN
C
        WRITE(GCHN.30) (QEW(I).I=1.3)
        WRITE(GCHN.37) (QEW(I).I=4.6)
30      FORMAT(" ","!RVEC 165.0!STR/DATE:",3(1X.I2),"/")
37      FORMAT(" ","!RVEC 240.0!STR/TIME:",3(1X.I2),"/")
C
C       COLOUR ACCORDING TO SPEED OR OCCUPANCY
C
        IF (OCC) GO TO 65
        CALL FOVLD(1.OQSPD.0.IER)
        CALL QSPD
        CALL FOVRL(OQSPD.IER)
        GO TO 75
65      CALL FOVLD(1.OQOCC.0.IER)
        CALL QOCC
        CALL FOVRL(OQOCC.IER)
C
C       DISPLAY BRIDGES BETWEEN STA 6 & 7 AND BETWEEN 20 & 21
C
75      DO 700 I=1.4
        READ(PFILE.18) (IDATA(J).J=1.39)
        WRITE(GCHN.35) (IDATA(J).J=1.39)
700     CONTINUE
C
C       DISPLAY VECTORED RAMPS
C
        CALL FOVLD(1.ORAMPS.0.IER)
        CALL RAMPS
        CALL FOVRL(ORAMPS.IER)
C
C       DISPLAY MAINLINE STATIONS
C
        CALL FOVLD(1.ODETECTOR.0.IER)
        CALL DETECTOR
        CALL FOVRL(ODETECTOR.IER)
C
C       DISPLAY REST OF FILE (STREETS.ETC)
C
5       READ(PFILE.18.END=99) (IDATA(I).I=1.39)
        WRITE(GCHN.35) (IDATA(I).I=1.39)
        GO TO 5
C
C       CALL FLASH IF AN ACCIDENT HAS BEEN DETECTED
C
99      CONTINUE
        IF(.NOT. AFLG) GO TO 300          !NO ACCIDENT DETECTED
C
```

```
C       GET LOCATIONS OF FIRST 3 ACCIDENTS
C
        CALL FOVLD(1,OFACC,0,IER)
        CALL FACC
        CALL FOVRL(OFACC,IER)
C
C       WRITE THE POLYGONS FOR THE ACCIDENT LOCATIONS INTO A TEMPORARY FILE
C
        CALL FOVLD(1,OFLASH,0,IER)
        CALL FLASH
        CALL FOVRL(OFLASH,IER)
C
C       FLASH POLYGONS BY LOOPING ON "TEMPFILE"
C
        CALL FOVLD(1,OLOOP,0,IER)
        CALL LOOP
        CALL FOVRL(OLOOP,IER)
C
        GO TO 300
C
C ***   I N T E R C H A N G E     D I S P L A Y S     ***
C
C
C
C       INITIALIZE DL,CL,PL ELEMENTS
C       DETERMINE NUMBER OF MAINLINE STATIONS FOR DISPLAY
C       PLACE HEADING ,DATE,TIME
C
        CALL FOVLD(1,ODISMAP,0,IER)
        CALL DISMAP
        CALL FOVRL(ODISMAP,IER)
        IF(OCC) GO TO 150;                IF TRUE, COLOR BASED ON OCCUPANCY
C
C ***** COLOUR CRITERIA  S P E E D  *****
C
        DO 100 I=1,NSTA
        CALL FOVLD(1,OSPD1,0,IER)
        ISCL=ISCL-9
        ISPL=ISPL-9
        CALL SPD1
        CALL FOVRL(OSPD1,IER)
C
        CALL FOVLD(1,OSPD2,0,IER)
        ISOL=ISOL-9
        CALL SPD2
        CALL FOVRL(OSPD2,IER)
100     CONTINUE
C
        CALL FOVLD(1,ORAMPS,0,IER)
        CALL RAMPS
        CALL FOVRL(ORAMPS,IER)
C
        GO TO 200
C
C ***** COLOUR CRITERIA  O C C U P A N C Y  *****
C
150     CALL FOVLD(1,OIOC1,0,IER)
C
        DO 175 I=1,NSTA
        IODL=IODL-9
        IOCL=IOCL-9
        IOPL=IOPL-9
        CALL IOC1         ; SET COLOUR AND DRAW DL,CL,PL
175     CONTINUE
C
        CALL FOVRL(OIOC1,IER)
C
        IF(MAPNUM .NE. 3) GO TO 180;            NOT DISPLAYING WINSTON
C
        CALL FOVLD(1,OIOC2,0,IER)
        CALL IOC2
        CALL FOVRL(OIOC2,IER)
C
C       DISPLAY INTERCHANGE RAMPS AS POLYGONS
C
180     CALL FOVLD(1,ORAMPS,0,IER)
        CALL RAMPS
        CALL FOVRL(ORAMPS,IER)
C
C       READ NUMBER OF RAMP CONTROLLERS;
C       INITIALIZE SPEED,VOLUME AND OCCUPANCY ELEMENTS;
C       DRAW GREEN BOXES
C
200     CALL FOVLD(1,OBOX1,0,IER)
        CALL BOX1
        CALL FOVRL(OBOX1,IER)
```

```
C
C      DISPLAY MAINLINE AND RAMP STATION DATA
C
       CALL FOVLD(1,OBOX2,0,IER)
       CALL BOX2
       CALL FOVRL(OBOX2,IER)
C
C      DISPLAY CYCLE TIME FOR ON RAMPS AND
C      STATION DATA FOR 15A ON MISS ROAD
C
       CALL FOVLD(1,OBOX3,0,IER)
       CALL BOX3
       CALL FOVRL(OBOX3,IER)
C
C      DISPLAY REST OF FILE
C              -MISCELLANEOUS POLYGONS
C              -DETECTOR STATIONS
C              -RAMP METERING ARROWS
C              -LEGEND,TEXTUAL DATA,NORTH POINT
C
       CALL FOVLD(1,ORDISMAP,0,IER)
       CALL RDISMAP
       CALL FOVRL(ORDISMAP,IER)
C
C      CLOSE POLYGON FILE CHANNEL
C
300    CONTINUE
       CALL CLOSE(PFILE,IER)
       IF (IER .NE. 1)
     *   TYPE "PFILE CLOSE IER =", IER
C
C      END OF ROUTINE
C
       GO TO 600
       END
```

```
C
          OVERLAY OHEADING
          SUBROUTINE HEADING
C
C
          EXTERNAL CLOCK
C
          COMMON/NREC/KL30S,NWREC,KINC,K5M,NALREC,KDISP
          COMMON/WKDAY/HMS(3),MDY(3)
          COMMON/WPV/WEATHER(36)
C
          INTEGER KL30S,NWREC,KINC,K5M,NALREC,KDISP
          INTEGER HMS,MDY
          INTEGER WEATHER
C
C
C
C
C
C         GET TODAY'S DATE
C
          CALL DATE (MDY(1), IER)
          WEATHER(1)=MDY(3)
          WEATHER(2)=MDY(1)
          WEATHER(3)=MDY(2)
C
C         GET CONDITIONS
C
          WRITE(10,310)
310       FORMAT (' ENTER CONDITIONS:' / '   WEATHER      >',Z)
          READ(11,390) (WEATHER(I), I=8.16)
          WRITE(10,320)
320       FORMAT ('   PAVEMENT   [illegible]
          READ(11,390) (WEATHER(I[illegible]18.26)
          WRITE(10,330)
330       FORMAT ('   VISIBILITY   [illegible])
          READ(11,390) (WEATHER(I), I=28.36)
390       FORMAT (9A2)
C
C         WAIT TILL MULTIPLE OF 5 MINUTES (E.G., 6:05, 7:40, 9:00, ETC.)
C
130       CALL TIME (HMS(1), IER)
          IF (.NOT. ( (MOD(HMS(2),5).EQ.0) .AND. (HMS(3).EQ.0) ) )
     *      GO TO 130
          WEATHER(4)=HMS(1)
          WEATHER(5)=HMS(2)
          WEATHER(6)=HMS(3)
C
C         PRINT HEADING
C
          WRITE(10,120) (WEATHER(I), I=1.6)
120       FORMAT (/1X,"* WELCOME TO Q.E.W. SURV. AND CONTROL PROJECT *",
     *            /1X,"*       COURTESY OF SYSTEMS RESEARCH - M.T.C.     *",
     *            /1X,"* TO-DAY'S DATE: ",I2,"/",I2,"/",I2,
     *            6X,"TIME: ",I2,":",I2,":",I2," *")
C
C         DEFINE USER CLOCK
C
          CALL DUCLK (10, CLOCK, IER)
          IF (IER .NE. 1)
     *      TYPE "DUCLK IER =", IER
C
C         SAVE INITIAL DATE, TIME, AND WEATHER IN 'WEATHER' FILF
C
          CALL OPEN(2,"WEATHER",3,IER,2*36)
          CALL WRITR(2,NWREC,WEATHER(1),1,IER)
          CALL CLOSE(2,IER)
          NWREC=NWREC+1
C
C         END OF ROUTINE
C
          RETURN
          END
```

```
      OVERLAY OINCDET
      SUBROUTINE INCDET
      DIMENSION INCLOG(25)
      DIMENSION CSOCC(22),PSOCC(22),SOCC1M(22),SVOL1M(22)
      COMMON/INCA/INCTV(84),INCREC(21),INCFLAG(21),INCSTAT(21)
      COMMON/INCB/OCCDBI(21),OCCUBI(21),INCNT(21),INCONT,INCEX
      COMMON/INCC/THRMOL
      COMMON/INCE/CHCK(21),CMNI1(21),CMNJ(21),TEST3,
      COMMON/WKDAY/HMS(3),MDY(3)
      COMMON/GEOM/STOT,DTOT,NRAMPS,NSTNS,CAP(22)
      COMMON/SECTL/DIST(20)
      COMMON/TTS/TT(20)
      COMMON/D30/DATA30(718)
      COMMON/NREC/KL30S,NWREC,KINC,KSM,NALREC,KDISP
      INTEGER INCLOG
      INTEGER CSOCC,PSOCC,SOCC1M,SVOL1M
      INTEGER INCTV,INCREC,INCFLAG,INCSTAT
      INTEGER OCCDBI,OCCUBI,INCNT,INCONT,INCEX
      INTEGER THRMOL
      INTEGER HMS,MDY
      INTEGER STOT,DTOT,NRAMPS,NSTNS,CAP
      INTEGER DIST
      INTEGER TT
      INTEGER DATA30
      INTEGER KL30S,NWREC,KINC,KSM,NALREC,KDISP
      INTEGER NSTNM1,I1,J,K,KK,IK
      INTEGER TEST1,TEST2,TEST4,OCCAVG,PSOD,IDIFF
      INTEGER MOL,IJ,IJ1,ITT,ISUM
      INTEGER CHCK,CMNJ,CMNI1,TEST3
      EQUIVALENCE (CSOCC(1),DATA30(543)),(PSOCC(1),DATA30(565)),
     *(SOCC1M(1),DATA30(587)),(SVOL1M(1),DATA30(609))
C
C
      NSTNM1=NSTNS-1
      DO 99 I=1,NSTNM1
      CHCK(I)=1
      KK=6*I-5
      I1=1 ;UPSTR. STN NO
      IF(I.EQ.2.OR.I.EQ.3)I1=I-1
      IF(CSOCC(I1).LT.0)GOTO 100 ;UPSTR. STN FAIL
      J=1
5     IF(I.EQ.1.AND.J.GE.4)GOTO 7
10    J=J+1 ;DOWNSTR. STN NO.
7     IF(J.GT.NSTNS)GOTO 100
      IF(I.EQ.3)GOTO 100 ;STN3 HAS NO DOWNSTR STN
      IF(CSOCC(J).GE.0.AND.SOCC1M(J).GE.0)GOTO 15
      IF(I.EQ.1)J=J+1
      IF(I.EQ.1)GOTO 5
      GOTO 10
C
C     COMPUTE TEST1,2,3,4 STATISTICS
C
15    CMNI1(I)=I1
      CMNJ(I)=J
      TEST1=CSOCC(I1)*4/9 ;U. STN OCC IN %*10
      PSOD=CSOCC(J)*4/9 ;D.STN OCC IN %*10
      TEST2=TEST1-PSOD ;TEST2 IN %*10
      TEST3=-999
      TEST1=(TEST1+5)/10  ;TEST1 IN %,ROUND-OFF
      IF(TEST1.GT.0)TEST3=TEST2*10/TEST1 ;TEST3 IN %
      OCCAVG=SOCC1M(J)*2/9;AVG D. OCC IN %*10
      IDIFF=OCCAVG-PSOD
      TEST4=999
      IF(IDIFF.LT.0)TEST4=-999
      PSOD=(PSOD+5)/10  ;PSOD IN %
      TEST2=(TEST2+5)/10  ;TEST2 IN %
      OCCAVG=(OCCAVG+5)/10 ;OCCAVG IN %
      IF(OCCAVG.GT.0)TEST4=IDIFF*10/OCCAVG ;TEST4 IN %
      K=4*I-3
      IF(INCFLAG(I).EQ.0) GOTO 13      ;NO INCIDENT DETECTED
      IF(INCSTAT(I).EQ.0) GOTO 99      ;INCIDENT NOT YET CONFIRMED
      GO TO 20
C
C CHECK INCIDENT OCCURRENCE
C
13    IF(TEST1.LT.INCTV(K))GOTO 100 ;NO PREV INC
      IF(TEST2.LT.INCTV(K+1).OR.TEST3.LT.INCTV(K+2))GOTO 100; NO INC
      IF(TEST4.LT.INCTV(K+3))GOTO 100; NO INC
      INCFLAG(I)=1 ;INC DETECTED
      OCCUBI(I)=OCCAVG ;DOWNSTR OCC JUST BEFORE INC
      OCCUBI(I)=PSOCC(I1) ;UPSTR OCC JUST BEFORE INC
      GOTO 99
20    IF(TEST3.GE.INCTV(K+2))GOTO 99 ;INC STILL ON
      IF(PSOD.GE.OCCDBI(I).AND.OCCUBI(I).LT.0)GOTO 17 ;INC CLEARED
      IF(PSOD.LT.OCCDBI(I).OR.CSOCC(I1).GT.OCCUBI(I))GOTO 99; INC STILL ON
```

```
        IF(PSUD.EQ.0.AND.OCCDBI(I).EQ.0)GOTO 99 ;INC STILL ON
17      INCFLAG(I)=0 ;INC CLEARED
        OCCDBI(I)=0
        OCCUBI(I)=0
        INCONT=0
        GO TO 99
100     CHCK(I)=0
99      CONTINUE
        RETURN
        END
```

```
C
      OVERLAY OINITIALIZE
      SUBROUTINE INITIALIZE
C
C
      EXTERNAL COMCOM,TRANSF,CORCAS,GMAP
C
      COMMON/SGN1/XMTBUF(45),RCVBUF(45),SGNADR(2)
      COMMON/SGN2/NWORDS,BUFSIZ,NMSGTX,NMSGRX,MTLSGN(2)
      COMMON/D30/DATA30(718)
      COMMON/NREC/KL30S,NWREC,KINC,KSM,NALREC,KDISP
      COMMON/WOFIL/WORCD,RSDVR(21)
      COMMON/SCREEN/GCHN,PFILE,RQEW,RWTEMP
C
      INTEGER XMTBUF,RCVBUF,SGNADR
      INTEGER NWORDS,BUFSIZ,NMSGTX,NMSGRX,MTLSGN
      INTEGER DATA30
      INTEGER KL30S,NWREC,KINC,KSM,NALREC,KDISP
      INTEGER WORCD,RSDVR
      INTEGER GCHN,PFILE,RQEW,RWTEMP
C
      INTEGER IAWS,IER,DMPREC(8)
C
C
C
C
C     INITIALIZE TASKS
C
      CALL ITASK (COMCOM, 10, 1, IER)
      IF (IER .NE. 1)
     *   TYPE "COMCOM ITASK IER =", IER
      CALL ITASK (TRANSF, 30, 4, IER)
      IF (IER .NE. 1)
     *   TYPE "TRANSF ITASK IER =", IER
      CALL ITASK (CORCAS, 20, 5, IER)
      IF (IER .NE. 1)
     *   TYPE "CORCAS ITASK IER =", IER
      CALL ITASK (GMAP,40,6,IER)
      IF (IER .NE. 1)
     *   TYPE "GMAP ITASK IER =", IER
C
C     DEFINE ISI/3M 300 DMA CHANNEL TO NOVA 4/X
C
      CALL IBDEF (IER)
      IF (IER.NE.1)
     *   TYPE "IBDEF IER =", IER
C
C     OPEN CHANNEL TO TEKTRONIX 4027 GRAPHICS TERMINAL
C
      CALL OPEN (GCHN, 'STTO1', 3, IER, 2*39)
      IF (IER .NE. 1)
     *   TYPE "GCHN OPEN IER =", IER
C
C     PROMPT FOR COLD OR WARM START
C
      WRITE (10, 25)
25    FORMAT ('ODO YOU WANT A COLD START? (Y/N) >', Z)
      READ  (11, 35) IANS
35    FORMAT (A2)
      IF (IANS .EQ. 'N ')
     *   GO TO 100
C
C     COLD START => DELETE AND RE-CREATE OUTPUT FILES
C
      CALL DFILW ("WEATHER", IER)
      CALL DFILW ("DATA30", IER)
      CALL DFILW ("INCLOG", IER)
      CALL DFILW ("DATASM", IER)
      CALL DFILW ("ALMREC", IER)
      CALL DFILW ("QEWDYN", IER)
      CALL DFILW ("XMTTAB", IER)
      CALL DFILW ("RESDEV", IER)
C
      CALL CFILW("WEATHER",2,IER)
      CALL CFILW("DATA30",2,IER)
      CALL CFILW("INCLOG",2,IER)
      CALL CFILW("DATASM",2,IER)
      CALL CFILW("ALMREC",2,IER)
      CALL CFILW("QEWDYN",2,IER)
      CALL CFILW("XMTTAB",2,IER)
      CALL CFILW("RESDEV",2,IER)
      GO TO 999
C
C     WARM START => GET FILE POINTERS FROM FILE 'DMPREC'
C
100   CONTINUE
```

```
      CALL OPEN(2,"DMPREC",1,IER,2*8)
      CALL READR(2,1,DMPREC(1),1,IER)
      CALL CLOSE(2,IER)
C
      KL30S=DMPREC(1)
      NWREC=DMPREC(2)
      KINC=DMPREC(3)
      KSM=DMPREC(4)
      NALREC=DMPREC(5)
      KDISP=DMPREC(6)
      NMSGTX=DMPREC(7)
      ROWCD=DMPREC(8)
C
      IF(NMSGTX.EQ.0)GO TO 999
      CALL OPEN (2,"XMTTAB",1,IER,2*45)
      CALL READR (2,NMSGTX,DATA30(1),1,IER)
      CALL CLOSE (2,IER)
      DO 150 I=1,BUFSIZ
         XMTBUF(I)=DATA30(I+6)
150     CONTINUE
      GO TO 999
C
C     END OF ROUTINE
C
999   CONTINUE
      RETURN
      END
```

```
C
      COMPILER NOSTACK
      OVERLAY OINPEDIT
      SUBROUTINE INPEDIT(ICODE,INUM,ICHAR,NVAR,ICOUNT,ICHCNT,COM1,COM2)
C
C
      INTEGER COM1,COM2,ICODE(30),INUM(0:30),ICHAR(60),IN(62),DIGIT
      INTEGER NUM(0:9)
      LOGICAL CHAR,CONTIG
C
      DATA NUM(0) /'0 ','1 ','2 ','3 ','4 ','5 ','6 ','7 ','8 ','9 '/
C
C     THIS SUBROUTINE SEPARATES THE INTEGER INPUT FROM THE CHARACTER INPUT
C     ONLY CHARACTER AND NON-NEGATIVE INPUT IS ALLOWED
C
C     VARIABLES:
C     ---------
C             IN     -ARRAY HOLDING COMMAND STRING (ONE CHARACTER PER ELEMENT)
C             INUM   -ARRAY HOLDING INTEGER INPUT
C             ICHAR  -ARRAY HOLDING CHARACTER INPUT
C                       AFTER EACH CHARACTER STRING  A BLANK IS PLACED
C             ICODE  -ARRAY HOLDING ORDER IN WHICH CHARACTERS AND INTEGERS
C                     APPEAR IN COMMAND LINE
C                        1=INTEGER
C                        2=CHARACTER
C             ICOUNT-THE NUMBER OF INTEGERS
C             ICHCNT-THE NUMBER OF CHARACTERS
C             NVAR   -THE NUMBER OF VARIABLES
C             CONTIG-FLAG TO INDICATE IF DIGIT IS PART OF PREVIOUS VARIABLE
C             CHAR   -FLAG TO INDICATE A CHARACTER STRING
C
5     CONTIG=.FALSE.
      CHAR=.FALSE.
      DO 1 I=1,ICHCNT
1     ICHAR(I)=20040K
      DO 2 I=1,ICOUNT
2     INUM(I)=0
      DO 3 I=1,NVAR
3     ICODE(I)=0
      NVAR=0
      ICOUNT=0
      ICHCNT=0
7     WRITE(10,250)
      READ(11,300)IN
      IF(IN(61).EQ.'  '.AND.IN(62).EQ.'  ')GO TO 10
      TYPE "COMMAND LINE OVER 60 CHARACTERS LONG"
      GO TO 7
10    DO 200 L=1,60
      DO 15 N=0,9
      IF(NUM(N).EQ.IN(L))GO TO 100 ; NUMERIC
15    CONTINUE
      IF(CHAR)GO TO 30
      IF(.NOT.CONTIG)GO TO 20
      IF(IN(L).EQ.'  ')GO TO 45
17    TYPE "NO SPACE BETWEEN NUMERIC AND CHARACTER"
      GO TO 5
20    IF(IN(L).EQ.'  ')GO TO 200
      CONTIG=.TRUE.
      CHAR=.TRUE.
      NVAR=NVAR+1
      ICODE(NVAR)=2
30    ICHCNT=ICHCNT+1
      IF(IN(L).EQ.'  ')GO TO 40
      ICHAR(ICHCNT)=IN(L)
      GO TO 200
40    CHAR=.FALSE.
45    CONTIG=.FALSE.
      GO TO 200
100   IF(CHAR)GO TO 17
      IF(CONTIG)GO TO 110
      DIGIT=0
      NVAR=NVAR+1
      ICODE(NVAR)=1
      CONTIG=.TRUE.
      ICOUNT=ICOUNT+1
110   IF(INUM(ICOUNT).EQ.0.AND.N.EQ.0)GO TO 200
      DIGIT=DIGIT+1
      IF(DIGIT.LT.5)GO TO 150
      IF(IN(L+1).EQ.'  ')GO TO 140
120   TYPE "INTEGER OVERFLOW, NUMBER > 32767"
      GO TO 5
140   IF(INUM(ICOUNT).GT.3276)GO TO 120
      IF(INUM(ICOUNT).LT.3276)GO TO 150
      IF(N.GT.7)GO TO 120
```

```
150     INUM(ICOUNT)=INUM(ICOUNT)*10+N
200     CONTINUE
250     FORMAT(' >',Z)
300     FORMAT(62A1)
        IF(NVAR.NE.0)GOTO 320
        WRITE(10,310)COM1,COM2
310     FORMAT(/1X,2A2)
        GOTO 5
320     IF(ICHAR(1).NE.15440K)GOTO 400 ; ESC
        CALL SPKIL("STTO",IER)
        GOTO 5
C
400     RETURN
        END
```

```
      OVERLAY OIOC1
      SUBROUTINE IOC1
C
C
C
C FUNCTION: DETERMINE THE COLOUR TO PAINT THE INTERCHANGF LANES
C           BASED UPON THE 1 MINUTE MAINLANE DATA,ACCORDING TO OCC
C
      COMMON/QEWDATA/QEW
      COMMON/SCREEN/GCHN.PFILE.RQEW.RWTEMP
      COMMON/OPTB/IODL.IOCL.IOPL
      COMMON/WORDS/NSTA.NCON.IS.IV.IO.RO.RV.TXT.K.K1
      INTEGER NSTA.NCON.IS.IV.IO.RO.RV.TXT(6).K.K1.IDATA(39)
      INTEGER QEW(512).GCHN.PFILE.RQEW.RWTEMP
C
C     TEST OCCUPANCY ON PASSING LANE
C
      IF(QEW(IOPL) .GT. 30) WRITE(GCHN.100)
      IF(QEW(IOPL) .GE. 20 .AND. QEW(IOPL) .LE. 30) WRITE(GCHN.400)
      IF(QEW(IOPL) .LT. 20) WRITE(GCHN.200)
      IF(QEW(IOPL) .LT. 0) WRITE(GCHN.800)
C
C     PAINT PASSING LANE
C
C
900   READ(PFILE.18) (IDATA(I).I=1.39)
      WRITE(GCHN.35) (IDATA(I).I=1.39)
      KK=ISHFT(IDATA(39).8)+46K
      IF(KK .EQ. K .OR. IDATA(37) .EQ. K1) GOTO 900
C
C     TEST OCCUPANCY ON CENTRE LANE
C
      IF(QEW(IOCL) .GT. 30) WRITE(GCHN.100)
      IF(QEW(IOCL) .GE. 20 .AND. QEW(IOCL) .LE. 30) WRITE(GCHN.400)
      IF(QEW(IOCL) .LT. 20) WRITE(GCHN.200)
      IF(QEW(IOCL) .LT. 0) WRITE(GCHN.800)
C
C     PAINT CENTRE LANE
C
C
1000  READ(PFILE.18) (IDATA(I).I=1.39)
      WRITE(GCHN.35) (IDATA(I).I=1.39)
      KK=ISHFT(IDATA(39).8)+46K
      IF(KK .EQ. K .OR. IDATA(37) .EQ. K1) GOTO 1000
C
C     TEST OCCUPANCY ON DRIVING LANE
C
      IF(QEW(IODL) .GT. 30) WRITE(GCHN.100)
      IF(QEW(IODL) .GE. 20 .AND. QEW(IODL) .LF. 30)WRITE(GCHN.400)
      IF(QEW(IODL) .LT. 20) WRITE(GCHN.200)
      IF(QEW(IODL) .LT. 0) WRITE(GCHN.800)
C
C     PAINT DRIVING LANE
C
C
1100  READ(PFILE.18) (IDATA(I).I=1.39)
      WRITE(GCHN.35) (IDATA(I).I=1.39)
      KK=ISHFT(IDATA(39).8)+46K
      IF(KK .EQ. K .OR. IDATA(37) .EQ. K1 ) GOTO 1100
      RETURN
18    FORMAT(39A2)
35    FORMAT(" ".39A2)
100   FORMAT(" ","ICOL C1 C0")
400   FORMAT(" ","ICOL C4 C0")
200   FORMAT(" ","ICOL C2 C0")
800   FORMAT(" ","ICOL C7.C0")
      END
```

```
          OVERLAY OIOC2
          SUBROUTINE IOC2
C
CFUNCTION : PAINT THE EXTRA LANE ON WINSTON CHURCHILL BASED ON OCCUPANCY
C
          COMMON/QEWDATA/QEW
          COMMON/SCREEN/GCHN,PFILE,RQEW,RWTEMP
          COMMON/EXTRA/WINSTON
          COMMON/WORDS/NSTA,NCON.IS.IV.IO.RO.RV.TXT,K,K1
          LOGICAL WINSTON
          INTEGER NSTA,NCON,IS,IV,IO,RO,RV.TXT(6),K,K1,IDATA(39)
          INTEGER QEW(512),GCHN,PFILE,RQEW,RWTEMP
C
C         WINSTON CHURCHILL RD HAS AN EXTRA LANE CHECK IF DISPLAYING THIS MAP
C
          IF(WINSTON) RETURN  :TRUE IMPLIES LANE DATA HAS BEEN DISPLAYED
C
C         DETERMINE COLOUR TO PAINT EXTRA LANE
C
          IOEL=411
          IF(QEW(IOEL) .GT. 30) WRITE(GCHN,100)
          IF(QEW(IOEL) .GE. 20 .AND. QEW(IOEL) .LE. 30) WRITE(GCHN,400)
          IF(QEW(IOEL) .LT. 20) WRITE(GCHN,200)
          IF(QEW(IOEL) .LT. 0) WRITE(GCHN,800)
900       READ(PFILE,18) (IDATA(I),I=1,39)
          WRITE(GCHN,35) (IDATA(I),I=1,39)
          KK=ISHFT(IDATA(39),8)+46K
          IF(KK .EQ. K .OR. IDATA(37) .EQ. K1) GOTO 900
C
C         SET WINSTON=T AFTER PAINTING EXTRA LANE ONCE
C
          WINSTON=.TRUE.
          RETURN
18        FORMAT(39A2)
35        FORMAT(" ",39A2)
100       FORMAT(" ","!COL C1 C0")
400       FORMAT(" ","!COL C4 C0")
200       FORMAT(" ","!COL C2 C0")
800       FORMAT(" ","!COL C7 C0")
          END
```

```
C
        OVERLAY ULOOP
        SUBROUTINE LOOP
C
C       FUNCTION : TO FLASH POLYGONS AT ACCIDENT LOCATIONS (FIRST 3 LOC ONLY)
C
        COMMON/SCREEN/GCHN,PFILE,RQEW,RWTEMP
        COMMON/NACC/KCNT
        INTEGER IDATA(39)
C
        INTEGER GCHN,PFILE,RQEW,RWTEMP
C
C       LOOP ON TEMPFILE N TIMES TO FLASH THE ACCIDENT POLYGONS BTW C7 & C1
C
        IF(KCNT .EQ. 1) N=5
        IF(KCNT .EQ. 2) N=4
        IF(KCNT .EQ. 3) N=2
C
C       SET COLOUR TO BLACK (C7)
C
        DO 800 J=1,N
        WRITE(GCHN,1005)
        REWIND RWTEMP
50      READ(RWTEMP,100,END=700) (IDATA(I),I=1,39)
        WRITE(GCHN,200) (IDATA(I),I=1,39)
        GOTO 50
100     FORMAT(39A2)
200     FORMAT(" ",39A2)
C
C       CHANGE COLOUR TO RED (C1)
C
700     WRITE(GCHN,1007)
        REWIND RWTEMP
750     READ(RWTEMP,100,END=800) (IDATA(I),I=1,39)
        WRITE(GCHN,200) (IDATA(I),I=1,39)
        GOTO 750
800     CONTINUE
        CALL CLOSE(RWTEMP,IER)
        CALL DFILW("TEMPFILE",IER)
        RETURN
1005    FORMAT(" ","ICOL C7 C0")
1007    FORMAT(" ","ICOL C1 C0")
        END
```

```
C
        SUBROUTINE MODM1
C
        COMMON/COMM/DETECT(545),NDETRC
        COMMON/MD/MODEMT(299),MODEM(148),MODEM1(73),NUMMDM
        COMMON/PROT/CONMSG(2),REPLY(2),PROTOCOL,MSGID.KTIME,PSPRT
        COMMON/LIMTTS/MAXOCC,MAXSPD.IMIN,MAXVEH,STDLN,S1.S2
        COMMON/MOTBL/NERROR(73),MDMDET(73),XTB(180)
        COMMON/DINDX/XREFTB(180).XREF(113)
C
        INTEGER DETECT.NDETRC
        INTEGER MODEMT,MODEM,MODEM1,NUMMDM
        INTEGER CONMSG.REPLY,PROTOCOL,MSGID.KTIME.PSPRT
        INTEGER MAXOCC,MAXSPD,IMIN,MAXVEH.STDLN.S1.S2
        INTEGER NERROR,MDMDET,XTB
        INTEGER XREFTB.XREF
        INTEGER DIFF,J.ID1.ID2,NO,LIMIT
C
C
C
C
        DO 100 I=1,NUMMDM
        IF(I.EQ.37)GOTO 100: SIGN MODEM
        IF(I.LE.8)GOTO 100; MODEMS 1 TO 8 NOT USED
        IF(I.EQ.12.OR.I.EQ.19.OR.I.EQ.20.OR.I.EQ.24)GOTO 100;NOT USED
        IF(I.EQ.40.OR.I.EQ.46.OR.I.EQ.47.OR.I.EQ.48)GOTO 100;NOT USED
        IF(I.EQ.56.OR.(I.GE.59.AND.I.LE.64).OR.I.EQ.68)GOTO 100;NOT USED
        DIFF=MAXOCC-DETECT(470+I)
        IF(DIFF.LT.0)DIFF=-DIFF
        IF(DIFF.LE.2)DIFF=0 ;ALLOW DEVIATION OF 2 SAMPLES
        MODEM1(I)=MODEM1(I)+DIFF ;ACCUMULATE ERROR COUNTS
        NO=MOD(MDMDET(I),10) ;GET NO OF DET'S AT THAT ADDRESS
        IF(NO.LE.0)GOTO 100 ;NO OF DET'S AT THAT ADDRESS
        ID1=MDMDET(I)/10 ;GET START LOC OF FIRST DETECTOR
        ID2=ID1+NO-1 ;GET ENDING LOCATION
        IF(NERROR(I).GE.5)GOTO 120 ;LOOK FOR MODEM RECOVERY
        IF(DETECT(470+I).GT.0)GOTO 140 ;MODEM IS RESPONDING
        NERROR(I)=NERROR(I)+1 ;INC ERROR COUNTS
        IF(NERROR(I).LT.5)GOTO 100 ;NOT PERMANENT ERROR YET
        DO 110 J=ID1,ID2
110     XREFTB(XTB(J))=MOD(XREFTB(XTB(J)),1000)+1000
150     NERROR(I)=5
        GOTO 100
120     LIMIT=MAXOCC-2
        IF(DETECT(470+I).LT.LIMIT)GOTO 150 ;MODEM STILL IN ERR STATE
        NERROR(I)=NERROR(I)+1 ;INC RECOVERY COUNTER
        IF(NERROR(I).LT.10)GOTO 100 ;NOT RECOVERED YET
        DO 160 J=ID1,ID2
160     XREFTB(XTB(J))=MOD(XREFTB(XTB(J)),1000)
140     NERROR(I)=0 ;RESET NO RESPONSE ERROR COUNTER
100     CONTINUE
C
        KTIME=KTIME+1 ;COUNTER TO IDENTIFY 10-MIN TIME PERIOD
        IF(KTIME.LT.PSPRT) GO TO 999
        DO 200 I=1.NUMMDM
        MODEMT(151+I)=MODEM1(I)
        MODEM1(I)=0
200     CONTINUE
C
999     RETURN
        END
```

```
C
      SUBROUTINE NXFER
C
      DIMENSION SDVOL(46),SDOCC(46)
      DIMENSION DNVOL(67),UPVOL(67),DNOCC(67),UPOCC(67),LNSPD(67)
      DIMENSION LVCNT(67)
C
      COMMON/GEOM/STOT,DTOT,NRAMPS,NSTNS,CAP(22)
      COMMON/LIMITS/MAXOCC,MAXSPD,IMIN,MAXVEH,STDLN,S1,S2
      COMMON/D1S/VOL1S(46),OCC1S(46),DVOL1S(67),UVOL1S(67),DOCC1S(67),
     *UOCC1S(67),VSPEED(67),LVC1S(67),LTCOND(10)
      COMMON/ET/STIM1(46),DTIM1(67),DTIM2(67),UPTIM(67)
      COMMON/ALM1/APARM(6)
      COMMON/DINDX/XREFTB(180),XREF(113)
      COMMON/D30/DATA30(718)
      COMMON/CTRL4/CHEK1(10),CHEK2(10),LIGHTS(10)
C
      INTEGER SDVOL,SDOCC
      INTEGER DNVOL,UPVOL,DNOCC,UPOCC,LNSPD,LVCNT
      INTEGER STOT,DTOT,NRAMPS,NSTNS,CAP
      INTEGER MAXOCC,MAXSPD,IMIN,MAXVEH,STDLN,S1,S2
      INTEGER VOL1S,OCC1S,DVOL1S,UVOL1S,DOCC1S
      INTEGER UOCC1S,VSPEED,LVC1S,LTCOND
      INTEGER STIM1,DTIM1,DTIM2,UPTIM
      INTEGER APARM
      INTEGER XREFTB,XREF
      INTEGER DATA30
      INTEGER CHEK1,CHEK2,LIGHTS
      INTEGER IDX
C
      EQUIVALENCE (SDVOL(1),DATA30(49)),(SDOCC(1),DATA30(95)),
     *(DNVOL(1),DATA30(141)),(UPVOL(1),DATA30(208)),
     *(DNOCC(1),DATA30(275)),(UPOCC(1),DATA30(342)),
     *(LNSPD(1),DATA30(409)),(LVCNT(1),DATA30(476))
C
      DO 100 I=1,DTOT
      IF(DTIM1(I).LT.APARM(2).AND.DTIM2(I).LT.APARM(2).AND.
     *UPTIM(I).LT.APARM(2))GOTO 100 !NO VEH STOPPED OVER DETECTOR
      VSPEED(I)=VSPEED(I)*S1/10 !BECAUSE VEH STOPPED OVER DET
      DTIM1(I)=0
      DTIM2(I)=0
      UPTIM(I)=0
100   CONTINUE
      DO 110 I=1,STOT
      IF(STIM1(I).GE.APARM(2))STIM1(I)=0 !REINIT TO AVOID OVERFLOW
110   CONTINUE
      DO 200 I=1,STOT
      IDX=XREF(I)
      SDVOL(IDX)=VOL1S(I)
      SDOCC(IDX)=OCC1S(I)
      VOL1S(I)=0 !REINIT FOR 30 SECS
      OCC1S(I)=0
200   CONTINUE
      DO 250 I=1,DTOT
      IDX=XREF(STOT+I)
      DNVOL(IDX)=DVOL1S(I)
      UPVOL(IDX)=UVOL1S(I)
      DNOCC(IDX)=DOCC1S(I)
      UPOCC(IDX)=UOCC1S(I)
      LNSPD(IDX)=(VSPEED(I)+5)/10 !M/S
      LVCNT(IDX)=LVC1S(I)
      DVOL1S(I)=0 !REINIT FOR NEXT 30 SECS
      UVOL1S(I)=0
      DOCC1S(I)=0
      UOCC1S(I)=0
      LVC1S(I)=0
250   CONTINUE
C
      DO 300 I=1,NRAMPS
      LIGHTS(I)=LTCOND(I) !30 SEC LIGHT STATUS
      LTCOND(I)=0 !REINIT FOR NEXT 30 SECS
300   CONTINUE
C
      RETURN
      END
```

```
        INCREC(I)=KINC ;SAVE REC NO FOR CLEARANCE
        KINC=KINC+1
        CALL UPEN(3,"INCLOG",2,IER,2*25)
        GOTU 80
110     INCSTAT(I)=0 ;TRUE INC CLEARED
        CALL OPEN(3,"INCLOG",2,IER,2*25)
        CALL READR(3,INCREC(I),INCLOG,1,IER)
        INCLOG(9)=HMS(1) ;END TIME OF INC
        INCLOG(10)=HMS(2)
        INCLOG(11)=HMS(3)
        INCLOG(12)=((HMS(1)-INCLOG(6))*60+HMS(2)-INCLOG(7))*60+HMS(3)-
      * INCLOG(8) ;INC DURATION
80      CALL WRITR(3,INCREC(I),INCLOG,1,IER)
        CALL CLOSE(3,IER)
        IF(INCSTAT(I).EQ.0)INCREC(I)=0
30      INCNT(I)=0
100     CONTINUE
        RETURN
        END
      OVERLAY OPERCHK
      ~~SUBROUTINE PENCHK~~
      DIMENSION INCLOG(25)
      DIMENSION CSOCC(22),PSOCC(22),SOCC1M(22),SVOL1M(22)
      COMMON/INCA/INCTV(84),INCREC(21),INCFLAG(21),INCSTAT(21)
      COMMON/INCB/OCCDBI(21),OCCUBI(21),INCNT(21),INCDNT,INCEX
      COMMON/INCC/THRMQL
      COMMON/INCE/CHCK(21),CMNI1(21),CMNJ(21),TEST3
      COMMON/WKDAY/HMS(3),MDY(3)
      COMMON/GEOM/STOT,DTOT,NRAMPS,NSTNS,CAP(22)
      COMMON/SECTL/DIST(20)
      COMMON/TTS/TT(20)
      COMMON/D30/DATA30(718)
      COMMON/NWREC/KL30S,NWREC,KINC,K5M,NALREC,KDISP
      INTEGER INCLOG
      INTEGER CSOCC,PSOCC,SOCC1M,SVOL1M
      INTEGER INCTV,INCREC,INCFLAG,INCSTAT
      INTEGER OCCDBI,OCCUBI,INCNT,INCDNT,INCEX
      INTEGER THRMQL
      INTEGER HMS,MDY
      INTEGER STOT,DTOT,NRAMPS,NSTNS,CAP
      INTEGER DIST
      INTEGER TT
      INTEGER DATA30
      INTEGER KL30S,NWREC,KINC,K5M,NALREC,KDISP
      INTEGER NSTNM1,I1,J,K,KK,IK
      INTEGER MQL,IJ,IJ1,ITT,ISUM
      INTEGER CHCK,CMNJ,CMNI1,TEST3
      EQUIVALENCE (CSOCC(1),DATA30(543)),(PSOCC(1),DATA30(565)),
     *(SOCC1M(1),DATA30(587)),(SVOL1M(1),DATA30(609))
C
C
      NSTNM1=NSTNS-1
      DO 100 I=1,NSTNM1
      I1=CMNI1(I)
      J =CMNJ (I)
C
C 1-MIN PERSISTENCF CHECK
C INC DETECTED FOR LESS THAN 1 MIN IS REJECTED
C
      IF(CHCK(I).EQ.0)GOTO 100;       IF NO INCIDENT WAS DETECTED, GO TO NEXT STATION
      IF(INCFLAG(I).EQ.0.AND.INCSTAT(I).EQ.0)GOTO 30 ;NO TRUE INC
      IF(INCFLAG(I).EQ.INCSTAT(I))GOTO 100 ;TRUE INC STILL ON
      IF(INCFLAG(I).EQ.0)GOTO 110 ;TRUE INC CLEARED
      IF(TEST3.LT.INCTV(4*I-1)) GOTO 30
      INCNT(I)=INCNT(I)+1 ;TIME COUNTER FOR 1-MIN CHECK
      IF(INCNT(I).NE.3)GOTO 100 ;NOT 1-MIN YET
      INCSTAT(I)=1 ;INC CONFIRMED BY 1-MIN CHECK
      INCDNT=1 ;TO ALARM OPERATOR
      INCLOG(1)=MDY(3) ;REC DATE
      INCLOG(2)=MDY(1)
      INCLOG(3)=MDY(2)
      INCLOG(4)=I ;REC STN ID
      INCLOG(5)=0 ;LANE
      INCLOG(6)=HMS(1)
      INCLOG(7)=HMS(2)-1
      INCLOG(8)=HMS(3)
      IF(INCLOG(7).GE.0)GOTO 90
      INCLOG(6)=HMS(1)-1
      INCLOG(7)=59
C CALCULATE MAX QUEUE LENGTH
90    MQL=0 ;QUEUE LENGTH OUT OF CONTROL SECTION
      DO 92 IJ=1,I1
      IJ1=I1-IJ+1 ;STN UPSTR OF INC LOCATIONS TO BE SEARCHED
      IF(IJ1.EQ.3)GOTO 92 ;STN ON HWY 403
      IF(CSOCC(IJ1).GE.THRMQL.OR.CSOCC(IJ1).LT.0)GOTO 92
      MQL=IJ1 ;MAINLINE QUEUE LENGTH FOUND
      GOTO 94
92    CONTINUE
94    INCLOG(13)=MQL  ;MAX QUEUE LENGTH
C
      INCLOG(14)=SVOL1M(J) ;DOWNSTREAM VOL
      INCLOG(15)=CAP(J)-INCLOG(14)*60 ;MAX CAP REDUCTION
C CALCULATE TOTAL SECTION TRAVEL TIMES
      ITT=-1
      ISUM=0
      DO 52 IJ=1,20
      IF(TT(IJ).LT.0)GOTO 54
      ISUM=ISUM+TT(IJ)
52    CONTINUE
      ITT=ISUM
54    INCLOG(16)=ITT ;TT
C
      DO 120 IK=17,25
120   INCLOG(IK)=0
```

```
      OVERLAY OQOCC
      SUBROUTINE QOCC
C
C FUNCTION : COLOUR MAINLINE POLYGONS ACCORDING TO OCCUPANCY
C
C
      COMMON/QEWDATA/QEW
      COMMON/SCREEN/GCHN,PFILE,RQEW,RWTEMP
      COMMON/GEOM/STOT,DTOT,NRAMPS,NSTNS,CAP(22)
      COMMON/WORDS/NSTA,NCON,IS,IV,IO,RO,RV,TXT,K,K1
      INTEGER NSTA,NCON,IS,IV,IO,RO,RV,TXT(6),K,K1
      INTEGER GCHN,PFILE,IDATA(39)
      INTEGER STOT,DTOT,NRAMPS,NSTNS,CAP
      INTEGER QEW(512),RQEW,RWTEMP
C
C***  COLOUR BASED ON OCCUPANCY***
C
C     I1 = INITIAL WORD FOR OCCUPANCY OR SPEED AT STATION I
C     I1-5 REPRESENT THE WORD LOCATION FOR OCC AND SPEED AT THEIR
C               RESPECTIVE STATIONS. THERE ARE PRESENTLY 22 STATIONS
C            ALONG THE MAINLINE.
C
      I1=170
C
C     SET COLOUR BY LOOPING ON THE TOTAL # OF MAINLINE STATIONS
C
      DO 100 I=1,NSTNS
      I1=I1-5
      IF(QEW(I1) .GT. 30) WRITE(GCHN,300)
      IF(QEW(I1) .GE. 20 .AND. QEW(I1) .LE. 30) WRITE(GCHN,350)
      IF(QEW(I1) .LT. 20) WRITE(GCHN,375)
      IF(QEW(I1) .LT. 0) WRITE(GCHN,380)
380   FORMAT(" ","!COL C7 C0")
300   FORMAT(" ","!COL C1 C0")
350   FORMAT(" ","!COL C4 C0")
375   FORMAT(" ","!COL C2 C0")
C
C       TO EXTRACT THE POLYGON TO BE COLOURED ON THE Q DISPLAY
C
C
390   READ(PFILE,18) (IDATA(J),J=1,39)
      WRITE(GCHN,35) (IDATA(J),J=1,39)
      KK=ISHFT(IDATA(39),8)+46K
      IF(KK .EQ. K .OR. IDATA(37) .EQ. K1) GOTO 390
100   CONTINUE
18    FORMAT(39A2)
35    FORMAT(" ",39A2)
      RETURN
      END
      OVERLAY OQSPD
      SUBROUTINE QSPD
C
C FUNCTION : COLOUR MAINLINE POLYGONS ACCORDING TO SPEED
C
C
      COMMON/QEWDATA/QEW
      COMMON/SCREEN/GCHN,PFILE,RQEW,RWTEMP
      COMMON/GEOM/STOT,DTOT,NRAMPS,NSTNS,CAP(22)
      COMMUN/WORDS/NSTA,NCON,IS,IV,IO,RO,RV,TXT,K,K1
C
      INTEGER NSTA,NCON,IS,IV,IO,RO,RV,TXT(6),K,K1
      INTEGER GCHN,PFILE,IDATA(39)
      INTEGER QEW(512)
      INTEGER RQEW,RWTEMP
      INTEGER STOT,DTOT,NRAMPS,NSTNS,CAP
C
C
C
C ***   COLOUR BASED ON SPEED  ***
C
      I1=168
      DO 80 I=1,NSTNS
      I1=I1-5
      IF(QEW(I1) .GT. 100) WRITE(GCHN,3000)
      IF(QEW(I1) .GE. 80 .AND. QEW(I1) .LE. 100) WRITE(GCHN,375)
      IF(QEW(I1) .GE. 60 .AND. QEW(I1) .LT. 80) WRITE(GCHN,350)
      IF(QEW(I1) .GE. 40 .AND. QEW(I1) .LT. 60) WRITE(GCHN,400)
      IF(QEW(I1) .GE.  0 .AND. QEW(I1) .LT. 40) WRITE(GCHN,300)
      IF(QEW(I1) .LT. 0) WRITE(GCHN,380)
C
C
3000  FORMAT(" ","ICOL C3 C0")
300   FORMAT(" ","ICOL C1 C0")
350   FORMAT(" ","ICOL C4 C0")
375   FORMAT(" ","ICOL C2 C0")
380   FORMAT(" ","ICOL C7 C0")
400   FORMAT(" ","ICOL C5 C0")
C
500   READ(PFILE,18) (IDATA(J),J=1,39)
      WRITE(GCHN,35) (IDATA(J),J=1,39)
      KK=ISHFT(IDATA(39),8)+46K
      IF(KK .EQ. K .OR. IDATA(37) .EQ. K1) GOTO 500
80    CONTINUE
C
18    FORMAT(39A2)
35    FORMAT(" ",39A2)
C
      RETURN
      END
```

```
        OVERLAY OQUOCC
        SUBROUTINE QUOCC
        DIMENSION LQOCC(13)
        DIMENSION QUETAB(256),MQOCC(10),QL(2),CYCLES(50)
        COMMON/Q01/QOVR(10),QIND(10)
        COMMON/Q02/QWAIT(10),QLNTH(10)
        COMMON/Q03/KQCNT(10),KSTEP(10),KTLMT(10),KTHR
        COMMON/Q04/QOCCLB(10),QOCCUB(10)
        COMMON/CTRL1/CONTRL,MAXCYC,METER(10),MODCYC(10)
        COMMON/CTRL2/CYCOVR(10),RAMCYC(10)
        COMMON/GEOM/STOT,DTOT,NRAMPS,NSTNS,CAP(22)
        COMMON/D30/DATA30(718)
        COMMON/QDET/NPD,NDD,NED,NQD
        COMMON/QOC/QOCC(13)
C
        INTEGER LQOCC
        INTEGER QUETAB,MQOCC,QL,CYCLES
        INTEGER QOVR,QIND
        INTEGER QWAIT,QLNTH
        INTEGER KQCNT,KSTEP,KTLMT,KTHR
        INTEGER QOCCLB,QOCCUB
        INTEGER CONTRL,MAXCYC,METER,MODCYC
        INTEGER CYCOVR,RAMCYC
        INTEGER STOT,DTOT,NRAMPS,NSTNS,CAP
        INTEGER DATA30
        INTEGER NPD,NDD,NED,NQD
        INTEGER QOCC
        INTEGER IDX,K,I,N1,N2,I1,I2,IJ,J,ID,ID1
        EQUIVALENCE (LQOCC(1),DATA30(126))
C
C
        CALL OPEN(5,"QUETAB",1,IER,2*64)
        CALL READR(5,1,QUETAB(1),4,IER)
        CALL CLOSE(5,IER)
        CALL OPEN(5,"CYCLES",1,IER,2*50)
        CALL READR(5,1,CYCLES(1),1,IER)
        CALL CLOSE(5,IER)
C
C QUEUE LENGTH COMPUTATION USING TABLE LOOK-UP FROM "QUETAB"
C WHICH CONTAINS OBSERVED Q-OCC VS Q-LNTH DATA
C
        IF(CONTRL.EQ.0)RETURN
        IDX=NQD*9 ;THRES VALUES(OCC),9 PER Q-DETECTOR
        K=0
        DO 100 I=1,NRAMPS
        K=K+1 ;INDEX TO LOOK UP QOCC FOR THIS RAMP
        IF((CONTRL.EQ.1.OR.CONTRL.EQ.3).AND.METER(I).EQ.0)GOTO 170;NO METER
        IF(RAMCYC(I).EQ.6)GOTO 170
        IF(I.EQ.6.OR.I.EQ.7.OR.I.EQ.10)GOTO 20 ;RAMPS WITH 2 Q-DETECTORS
        IF(QOCC(K).GE.0)GOTO 60 ;RAMPS WITH 1 Q-DETECTOR
        GOTO 50
C RAMPS WITH 2 Q-DETECTORS
20      IF(QOCC(K).GE.0.OR.QOCC(K+1).GE.0)GOTO 40
50      QWAIT(I)=-1 ;SET TO -1 FOR HARDWARE FAIL.
        QLNTH(I)=-1
        QIND(I)=0
        GOTO 110
40      MQOCC(I)=MAX0(QOCC(K),QOCC(K+1))
        N1=(K-1)*9+1 ;FIRST Q-DETECTOR OCC INDEX
        N2=N1+9 ;2ND Q-DETECTOR INDEX
        J=-1  ;2 Q-DETECTORS ON THIS RAMP
        DO 48 I1=N1,N2,9
        I2=I1+8
        J=J+1
        DO 46 IJ=I1,I2
        IF(QOCC(K+J).LT.QUETAB(IJ))GOTO 44
        IF(IJ.NE.I2)GOTO 46
        ID=IDX+IJ+J+K ;INDEX TO LOCATE CORR Q-LNTH
        GOTO 42
44      ID=IDX+IJ+K+J-1 ;INDEX TO LOCATE CORR Q-LNTH
42      QL(J+1)=QUETAB(ID) ;QLNTH FOR Q-DETECTORS
        GOTO 48
46      CONTINUE
48      CONTINUE
        QLNTH(I)=MAX0(QL(1),QL(2)) ;Q-LNTH FOR RAMPS 7 $ 10
        IF(I.EQ.6)QLNTH(I)=QL(1)+QL(2) ;Q- LNTH FOR R6
        GOTO 70
C
C RAMPS WITH 1 Q-DETECTOR
C
60      MQOCC(I)=QOCC(K)
        I1=(K-1)*9+1
        I2=I1+8
        DO 62 IJ=I1,I2
        IF(QOCC(K).LT.QUETAB(IJ))GOTO 64
        IF(IJ.NE.12)GOTO 62
        ID=IDX+IJ+K
        GOTO 63
64      ID=IDX+IJ+K-1 !INDEX TO LOCATE CORR Q-LNTH
63      QLNTH(I)=QUETAB(ID)
        GOTO 70
62      CONTINUE
C
C
C
70      IF(QLNTH(I).GT.100)QLNTH(I)=100
C
C Q-OVERRIDE CONTROL BASED ON Q-OCC
C
        IF(QOVR(I).EQ.1.OR.CYCOVR(I).NE.8)GOTO 170 !QOVR DISABLED OR MAN.
        IF(QIND(I).EQ.1.AND.MQOCC(I).GE.QOCCLB(I))GOTO 150!QOVR STILL ON
        KQCNT(I)=0 !RESET QOVR STEP-DOWN TIME COUNTER
        KTLMT(I)=0 !RESET TIME LIMIT COUNTER
        IF(MQOCC(I).LT.QOCCUB(I))GOTO 170 !<UPPER B. THRESHOLD.NO QOVR
        QIND(I)=1 !TO IND. QOVR ON
        MODCYC(I)=4 !QOVR MODE
150     IF(RAMCYC(I).LE.1)GOTO 180
        IF(KQCNT(I).GE.KSTEP(I))KQCNT(I)=0 !TIME TO REDUCE 1 CYCLE
        IF(KQCNT(I).EQ.0)RAMCYC(I)=RAMCYC(I)-1 !YES
        KQCNT(I)=KQCNT(I)+1 !INCRE COUNT FOR CYC LNTH STEPDOWN
180     KTLMT(I)=KTLMT(I)+1 !INCRE COUNT FOR P.G.
        IF(KTLMT(I).GE.KTHR)RAMCYC(I)=0 !P. GREEN
        GOTO 160
170     QIND(I)=0
160     ID1=(I-1)*MAXCYC+RAMCYC(I)
        QWAIT(I)=QLNTH(I)*20 !ASSUME 2 SECS FOR P GREEN
        IF(RAMCYC(I).GT.0.AND.RAMCYC(I).LT.6)QWAIT(I)=QLNTH(I)*CYCLES(ID1)
110     IF(I.EQ.6.OR.I.EQ.7)K=K+1
100     CONTINUE
        RETURN
        END
```

```
C
      COMPILER NOSTACK
      SUBROUTINE RAMCON
C
C THIS ROUTINE ACCESSES 'RAMCYC' AND SETS UP CONTROL COMMANDS IN
C 'COMDOP' TO BE TRANSMITTED TO 2 DIFFERENT TYPES OF CONTROLLERS
C (CR710 AND C170). IT ALSO CHECKS TRANSMISSION ERRORS
C
      COMMON/COMM/DETEC1(545),NDETRC
      COMMON/GEOM/STOT,DTOT,NRAMPS,NSTNS,CAP(22)
      COMMON/CTRL1/CONTRL,MAXCYC,METER(10),MODCYC(10)
      COMMON/CTRL2/CYCOVR(10),RAMCYC(10)
      COMMON/CTRL3/CNTADR(10),CSTAT(10),LTSTAT(10)
      COMMON/CTRL4/CHEK1(10),CHEK2(10),LIGHTS(10)
      COMMON/CTRL6/COMDOP(8),CNTON(10),NBRAMP
      COMMON/CTRL7/ERRCNT(10),DFREQ
      COMMON/CTRL9/MCNT(10)
      INTEGER DETECT, NDETRC
      INTEGER STOT,DTOT,NRAMPS,NSTNS,CAP
      INTEGER CONTRL,MAXCYC,METER,MODCYC
      INTEGER CYCOVR,RAMCYC
      INTEGER CNTADR,CSTAT,LTSTAT
      INTEGER CHEK1,CHEK2,LIGHTS
      INTEGER COMDOP,CNTON,NBRAMP
      INTEGER ERRCNT,DFREQ
      INTEGER XMT170(5),RCV170(5),ERRB5(5)
      INTEGER MCNT
      INTEGER IDX,K,LMT
C
      DATA ERRBS(1) /5*0/
      DATA XMT170(1) /5*0/, RCV170(1) /5*0/
C
C
C
C LOOK FOR MANUAL OVERRIDE
C
      DO 260 I=1,NRAMPS
      IF(METER(I).EQ.0)MODCYC(I)=0 ;RAMP NOT METERED
      IF(CYCOVR(I).EQ.8)GOTO 260 ;NO OVERRIDE
      IF(CYCOVR(I).EQ.9)GOTO 270 ;OVERRIDE TO DROP OFFLINE
      METER(I)=1 ;THIS RAMP IS METERED NOW
      RAMCYC(I)=CYCOVR(I) ;UPDATE RAMCYC ACCORDINGLY
      MODCYC(I)=5 ;MANUAL CONTROL MODE
      GOTO 260
270   METER(I)=0
      RAMCYC(I)=0 ;TO DROP OFFLINE
260   CONTINUE
C
C DETERMINE WHETHER THIS TIME SLICE IS FOR TRANSMITTING COMMANDS TO
C C170 N/B OR S/B RAMPS
C
      NBRAMP=NBRAMP+1
      IF(NBRAMP.EQ.1)GOTO 100 ;TIME FOR C170 N/B RAMPS
      NBRAMP=0 ;TIME FOR C170 S/B RAMPS
C
C SET UP CONTROL COMMANDS FOR CR710; H.O.BYTE FOR COMMAND.L.O.BYTE
C FOR ADDRESS
C
100   DO 300 I=1,NRAMPS
      IF(I.LE.2.OR.I.GE.8)GOTO 300 ;C170
      IDX=MCNT(I)
      COMDOP(IDX)=(RAMCYC(I)+RAMCYC(I)+49)*256+CNTADR(I) ;HI-0011***1.LOW-ADDR
      IF(METER(I).EQ.0)COMDOP(IDX)=0 ;DROP CNTLER OFFLINE
300   CONTINUE
C
C SETS UP CONTROL COMMANDS FOR C170
C
      DO 400 I=1,NRAMPS
      IF(I.GE.3.AND.I.LE.7)GOTO 400 ;CR710
      IDX=MCNT(I)
      IF(I.EQ.10)GOTO 450 ;C170 WITH 1 RAMP ONLY
      IF(NBRAMP.EQ.1)GOTO 420 ;TIME FOR C170 N/B RAMPS
      IF(I.EQ.1.OR.I.EQ.8)GOTO 400 ;N/B RAMPS
      GOTO 450
420   IF(I.EQ.2.OR.I.EQ.9)GOTO 400 ;S/B RAMPS
450   COMDOP(IDX)=(RAMCYC(I)+16)*256+CNTADR(I) ;HI-0001****.LOW-ADDR
      IF(NBRAMP.EQ.1.OR.I.EQ.10)CALL ISET(COMDOP(IDX),15) ;HI-1001****
      IF(I.EQ.10)GOTO 470
      IF(NBRAMP.EQ.0)CALL ISET(COMDOP(IDX),14) ;HI-0101****
470   IF(CYCOVR(I).NE.9)GOTO 490
      CALL ICLR(COMDOP(IDX),12) ;HOLD-ON LINE BIT OFF
      IF(CNTON(I).EQ.0)COMDOP(IDX)=0 ;DROP OFFLINE AFTER SENDING HOL BIT 0
      CNTON(I)=0
      GOTO 400
490   CNTON(I)=1
```

```
400     CONTINUE
C
C STORE COMMANDS XMTED TO C170
C
        K=1
        IF(NBRAMP.EQ.0)K=2
        XMT170(K)=COMDOP(8)
        K=K+2
        XMT170(K)=COMDOP(6)
        XMT170(5)=COMDOP(7)
C
C STORE RETURN COMMANDS FOR C170
C
        K=1
        IF(ITEST(DETECT(8),6))K=2 ;S/B RAMP
        RCV170(K)=DETECT(8)
        K=3
        IF(ITEST(DETECT(6),6))K=4 ;S/B RAMP
        RCV170(K)=DETECT(6)
        RCV170(5)=DETECT(7)
C
C CHECK FOR TRANSMISSION ERRORS-MAKE SURE XMTED=RECEIVED
C
        DO 700 I=1,NRAMPS
        IF(I.LE.2.OR.I.GE.8)GOTO 700 ;C170 CONTROLLERS
        IDX=MCNT(I)
        IF(CSTAT(I).EQ.1)GOTO 690 ;ERROR ALREADY NOTED
        IF(METER(I).EQ.0)GOTO 690 ;RAMP NOT METERED
        CHEK1(I)=(DETECT(IDX).AND.62)*256 ;GET BITS 1-5 & MOVE LEFT 8 BITS
        CHEK2(I)=COMDOP(IDX).AND.15872 ;RETAIN BITS 9-13
        IF(CHEK1(I).EQ.CHEK2(I))GOTO 690
        ERRCNT(I)=ERRCNT(I)+1 ;INC ERROR COUNTS
        IF(ERRCNT(I).LE.OFREQ)GOTO 695 ;NO OF ERRORS IN ALLOWABLE RANGE
        GOTO 700
690     ERRCNT(I)=0
695     CHEK1(I)=0
        CHEK2(I)=0
700     CONTINUE
C
C    *****C170 CONTROLLERS******
C    *****RAMP 10 CHECKED EVERY SEC.ALL OTHERS EVERY 2 SECS*****
        K=0
        DO 800 I=1,NRAMPS
        IF(I.GE.3.AND.I.LE.7)GOTO 800 ;CR710 CONTROLLERS
        K=K+1
        LMT=30
        IF(I.EQ.10)GOTO 810 ;C170 CONTROLLER WITH 1 RAMP.CHECK EACH SEC
        IF(NBRAMP.EQ.1)GOTO 800 ;NOT TIME TO CHECK YET
        LMT=15
810     IF(CSTAT(I).EQ.1)GOTO 880 ;ERROR ALREADY NOTED
        IF(CYCOVR(I).EQ.9)GOTO 880 ;CONTROLLER OFFLINE
        CHEK1(I)=ISHFT(RCV170(K),8) ;MOVE LEFT 8 BITS
        CHEK2(I)=XMT170(K).AND.177400K ;RETAIN BITS 8-15
        RCV170(K)=0 ;REINIT RECEIVED BUFFER
        IF(ITEST(CHEK1(I),13))GOTO 850 ;RETURN MESSAGE BIT 5 ON ?
        ERRB5(K)=0
830     IF(CHEK1(I).EQ.CHEK2(I))GOTO 890
        ERRCNT(I)=ERRCNT(I)+1 ;INC ERROR COUNTS
        IF(ERRCNT(I).LT.LMT)GOTO 895
        GOTO 800
850     ERRB5(K)=ERRB5(K)+1 ;INCREMENT ERROR COUNT
        IF(ERRB5(K).GE.LMT)GOTO 800
        CALL ICLR(CHEK1(I),13)
        GOTO 830
880     ERRB5(K)=0
890     ERRCNT(I)=0
895     CHEK1(I)=0
        CHEK2(I)=0
800     CONTINUE
        RETURN
        END
```

```
      OVERLAY ORAMPS
      SUBROUTINE RAMPS
C
C
C FUNCTION : TO COLOUR THE VECTORED RAMPS FOR THE Q DISPLAY AND THE RAMP
C            POLYGONS FOR THE INTERCHANGE DISPLAYS. THE ROUTINE DETERMINES
C            WHICH MAP IS TO BE COLOURED AND BY MEANS OF POINTERS THE
C            THE APPROPRIATE POLYGON IS WRITTEN TO THE DISPLAY.
C     THE COLOUR IS BASED UPON QUEUE CONDITIONS WHICH ARE
C   PASSED BY THE LOGICAL VARIABLES NOTIN INAB,INBL.
C
      COMMON/GRAPH/MAPNUM.LMAP
      COMMON/RQOR/NOTIN.INBL.INAB
      COMMON/SCREEN/GCHN.PFILE.RQEW.RWTEMP
      COMMON/GEOM/STOT.OTOT.NRAMPS.NSTNS.CAP(22)
      COMMON/CREST/M.N
      COMMON/WORDS/NSTA.NCON.IS.IV.IO.RO.RV.TXT.K.K1
      INTEGER NSTA.NCON.IS.IV.IO.RO.RV.TXT(6).K.K1
      INTEGER STOT.OTOT.NRAMPS.NSTNS.CAP
      INTEGER M.N
      INTEGER LMAP.IDATA(39).GCHN.PFILE.RQEW.RWTEMP
      LOGICAL NOTIN(10).INAB(10).INBL(10)
C
C
C     CHECK IF DISPLAYING AN INTERCHANGE MAP.IF SO SKIP TO 30
C
      IF(MAPNUM .GT. 1) GOTO 30
C
C      M & N REPRESENT THE NUMBER OF RAMPS   IN QEWDYN.
C     NPOLY IS THE NUMBER OF POLYGONS REQ'D TO DISPLAY A GIVEN RAMP
C
C     M A I N   D I S P L A Y
C
      DO 25 I=1.NRAMPS
      IF(.NOT.NOTIN(I)) WRITE(GCHN,200)
      IF(.NOT.NOTIN(I)) GOTO 35
      IF(INBL(I)) WRITE(GCHN.210)
      IF(INAB(I)) WRITE(GCHN.220)
35    READ(PFILE.18) (IDATA(J).J=1.39)
18    FORMAT(39A2)
37    FORMAT(" ".39A2)
      WRITE(GCHN.37) (IDATA(J).J=1.39)
      KK=ISHFT(IDATA(39).8)+000046K
      IF(KK .EQ. K .OR. IDATA(37) .EQ. K1) GOTO 35
C
C     RAMPS UNDER A BRIDGE REQUIRE 2 VECTOR COMMANDS
C
      IF(I.EQ. 4 .OR. I.EQ. 9) GOTO 20
      GOTO 25
20    READ(PFILE.18) (IDATA(J).J=1.39)
      WRITE(GCHN.37) (IDATA(J).J=1.39)
      KK=ISHFT(IDATA(39).8)+46K
      IF(KK .EQ. K .OR. IDATA(37) .EQ. K1) GOTO 20
25    CONTINUE
      RETURN
C
C     I N T E R C H A N G E   D I S P L A Y S
C
C     READ FILE TO DETERMINE ELEMENT NUMBERS FOR THE INTERCHANGE
C     RAMP IN QUESTION
C
C
C     READ FILE TO DETERMINE ELEMENT NUMBERS FOR THE INTERCHANGE RAMP
C
30    READ(PFILE.27)M.N
27    FORMAT(2I2)
      DO 100 I=M.N
      IF(.NOT. NOTIN(I)) WRITE(GCHN.200)    ;FALSE IMPLIES NOT IN QOR
      IF(.NOT. NOTIN(I)) GOTO 55
      IF(INBL(I)) WRITE(GCHN.210)
      IF(INAB(I)) WRITE(GCHN.220)
C
C     INITIALIZE THE NUMBER OF POLYGONS TO DISPLAY A GIVEN RAMP
C
C     RAMPS UNDER BRIDGES REQUIRE 2 POLYGONS IE. CAWTHRA SB
C                                                HWY 10 SB
C                                                WINSTON SR
C
55    NPOLY=1
      IF(I.EQ.2.OR.I.EQ.4 .OR.I.EQ.9) NPOLY=2
C
C     READ RAMP POLYGONS FROM FILE
C
      DO 80 IPOLY=1.NPOLY
```

```
60        READ(PFILE,18) (IDATA(J),J=1,39)
          WRITE(GCHN,37) (IDATA(J),J=1,39)
          KK=ISHFT(IDATA(39),8)+46K
          IF(KK .EQ. K .OR. IDATA(37) .EQ. K1) GOTO 60
80        CONTINUE
100       CONTINUE
200       FORMAT(" ","!COL C2 C0")
210       FORMAT(" ","!COL C4 C0")
220       FORMAT(" ","!COL C1 C0")
          RETURN
          END
```

```
      OVERLAY ORCTIME
      SUBROUTINE RCTIME
      DIMENSION SOCC1M(22),SVOL1M(22)
      DIMENSION RAMTAB(40),CYCTAB(25)
      DIMENSION LQOCC(13)
      COMMON/Q01/QOVR(10),QIND(10)
      COMMON/Q02/QWAIT(10),QLNTH(10)
      COMMON/CTRL1/CONTRL,MAXCYC,METER(10),MODCYC(10)
      COMMON/CTRL2/CYCOVR(10),RAMCYC(10)
      COMMON/CTRL5/THRCP(4),CTRMOD
      COMMON/WKDAY/HMS(3),MDY(3)
      COMMON/GEOM/STOT,DTOT,NRAMPS,NSTNS,CAP(22)
      COMMON/D30/DATA30(718)
      COMMON/QOC/QOCC(13)
      COMMON/ROET/NPD,NOD,NED,NQD
      INTEGER SOCC1M,SVOL1M
      INTEGER RAMTAB,CYCTAB
      INTEGER QOVR,QIND
      INTEGER CONTRL,MAXCYC,METER,MODCYC
      INTEGER CYCOVR,RAMCYC
      INTEGER THRCP,CTRMOD
      INTEGER HMS,MDY
      INTEGER STOT,DTOT,NRAMPS,NSTNS,CAP
      INTEGER DATA30
      INTEGER INDEX,ID,K
      INTEGER LOCC,DOCC,VOL,CYC1,CYC2,CYC3,CYC
      INTEGER IHRMIN
      INTEGER QWAIT,QLNTH,QOCC
      EQUIVALENCE (SOCC1M(1),DATA30(587)),(SVOL1M(1),DATA30(609))
      EQUIVALENCE (LQOCC(1),DATA30(126))
C
C
      CALL OPEN(5,"RAMTAB",1,IER,2*40)
      CALL READR(5,1,RAMTAB(1),1,IER)
      CALL CLOSE(5,IER)
      CALL OPEN(5,"CYCTAB",1,IER,2*25)
      CALL READR(5,1,CYCTAB(1),1,IER)
      CALL CLOSE(5,IER)
C
C
C DETERMINE CONTROL PERIOD
C
      IF(CTRMOD.GE.4)GOTO 50 ;AUTO ADVANCEMENT IN CONTROL PERIOD
      CONTRL=CTRMOD ;MANUAL C.P. FROM OPERATOR
      GOTO 70
50    CONTRL=0
      IHRMIN=HMS(1)*100+HMS(2)
      DO 60 I=1,4
60    IF(IHRMIN.GE.THRCP(I))CONTRL=MOD(I,4)
C
70    CONTINUE
      IF(CONTRL.EQ.0)GOTO 450 ;CP=0,NO NEED TO CALCULATE ANYTHING
C
      DO 100 I=1,NRAMPS
      IF(CONTRL.EQ.3.AND.METER(I).EQ.0)GOTO 100 ;CONTROLLER OFFLINE
      IF(QOVR(I).EQ.1)QIND(I)=0 ;QOVR DISABLED
      IF(QIND(I).EQ.1)GOTO 100 ;QOVR ON
      IF(CYCOVR(I).NE.0)GOTO 100 ;MANUAL OVERRIDE FOR THIS RAMP
      INDEX=4*I-3
      ID=RAMTAB(INDEX) ;LOCAL STATION ID
      LOCC=SOCC1M(ID) ;LOCAL STN 1-MIN OCC
      ID=RAMTAB(INDEX+1) ;DOWNSTR STN ID
      DOCC=SOCC1M(ID) ;DOWNSTR STN 1-MIN OCC
      ID=RAMTAB(INDEX+2) ;UPSTR STN ID
      VOL=SVOL1M(ID) ;UPSTR STN 1 MIN VOL
      ID=RAMTAB(INDEX+3) ;CONTROL SECTION ID
C
C CYCLE LENGTH CALCULATIONS BASED ON MAINLINE CONDITIONS
C LOCAL OCC,DOWNSTREAM OCC,AND UPSTREAM VOL
C
      CYC1=0
      CYC2=0
      CYC3=0
      K=(ID-1)*MAXCYC
      DO 200 J=1,MAXCYC
      IF(LOCC.LT.CYCTAB(J))GOTO 210
      CYC1=J ;CYC LNTH BASED ON LOCAL OCC
210   IF(DOCC.LT.CYCTAB(J+MAXCYC))GOTO 220
      CYC2=J ;CYC LNTH BASED ON DOWNSTR OCC
220   IF(VOL.LT.CYCTAB(K+J))GOTO 200
      CYC3=J ;CYC LNTH BASED ON UPSTREAM VOL
200   CONTINUE
      CYC=MAX0(CYC1,CYC2,CYC3) ;PICK THE LARGEST VALUE
      IF(CONTRL.EQ.1.AND.METER(I).EQ.1.AND.CYC.EQ.0)CYC=1;MIN CYC,MET ON
      IF(CONTRL.EQ.2.AND.CYC.EQ.0)CYC=1;MIN CYC IN CP2
```

```
C
C CONTROL MODES
C
        IF(CYC1.GT.CYC2.AND.CYC1.GT.CYC3)MODCYC(I)=1 ;LOCAL OCC CONTROL
        IF(CYC2.GT.CYC1.AND.CYC2.GT.CYC3)MODCYC(I)=2 ;DOWNSTR OCC
        IF(CYC3.GT.CYC2.AND.CYC3.GT.CYC1)MODCYC(I)=3 ;UPSTR VOL
        IF(CYC1.EQ.CYC2.AND.CYC1.GT.CYC3)MODCYC(I)=6 ;LOCAL AND DOWNS OCC
        IF(CYC2.EQ.CYC3.AND.CYC2.GT.CYC1)MODCYC(I)=7 ;DOCC AND UPVOL
        IF(CYC3.EQ.CYC1.AND.CYC3.GT.CYC2)MODCYC(I)=8 ;LOCC AND UPVOL
        IF(CYC1.EQ.CYC2.AND.CYC1.EQ.CYC3)MODCYC(I)=9 ;LOCC.DOCC.UPVOL
        RAMCYC(I)=CYC  ;CYC LNTH OUTPUT
        METER(I)=1 ;METERING ON FOR POS CYC LNTH
        IF(CYC.EQ.0)METER(I)=0 ;NO METERING
100     CONTINUE
        GO TO 471
480     DO 470 I=1,NRAMPS
        IF(CYCOVR(I).NE.8)GOTO 470 ;THIS RAMP UNDER MANUAL OVERRIDE
        RAMCYC(I)=0 ;P GREEN
        METER(I)=0 ;NO METERING
470     CONTINUE
471     DO 900 I=1,NQD
        IF(QOCC(I).LT.0.AND.LQOCC(I).GE.0)QOCC(I)=0
        QOCC(I)=(6*QOCC(I)+4*LQOCC(I))/10
900     IF(LQOCC(I).LT.0)QOCC(I)=-1
C
        DO 700 I=1,NRAMPS
        QLNTH(I)=0
700     QWAIT(I)=0 ;INIT QLNTH & WAIT TIME TO 0
        RETURN
        END
```

```
C
        OVERLAY URDISMAP
        SUBROUTINE RDISMAP
C
C FUNCTION : TO DISPLAY NON DESCRIPTIVE GRAPHICS FOR INTERCHANGE DISPLAYS
C                -CHECKS FOR MISCELLANEOUS POLYGONS & DISPLAYS IN GREEN
C                -DETERMINES THE NUMBER OF DETECTOR STATIONS AND DISPLAYS
C                -DISPLAYS RAMP METERING ARROWS
C                -LEGEND
C                -TEXTUAL DATA FOR CLARITY
C                -NORTHPOINT
C
C
        COMMON/SCREEN/GCHN.PFILE.RQEW.RWTEMP
        COMMON/OCCRM/OCC.RMETER
        COMMON/CREST/M.N
        COMMON/WORDS/NSTA.NCON.IS.IV.IO.RO.RV.TXT.K.K1
C
        INTEGER NSTA.NCON.IS.IV.IO.RO.RV.TXT(6).K.K1
        INTEGER IDATA(39)
        INTEGER GCHN.PFILE.RQEW.RWTEMP
C
        LOGICAL RMETER(10).OCC
C
C       CHECK FOR MISCELLANEOUS POLYGONS AND DISPLAY IN GREEN
C
        READ(PFILE.100) MISPOLY
        IF(MISPOLY.LT.1) GO TO 130
        WRITE(GCHN.250)
        DO 200 J=1.MISPOLY
127     READ(PFILE.18) (IDATA(I).I=1.39)
        WRITE(GCHN.35) (IDATA(I).I=1.39)
        KK=ISHFT(IDATA(39).8)+46K
        IF(KK .EQ. K .OR. IDATA(37) .EQ. K1) GOTO 127
200     CONTINUE
250     FORMAT(" ","!COL C2 C0")
C
C       READ TOTAL NUMBER OF DETECTORS FOR THIS DISPLAY
C       DISPLAY DETECTOR STATIONS FOR INTERCHANGES WHITE ON BLACK
C
130     READ(PFILE.110) NDP
100     FORMAT(I1)
110     FORMAT(I2)
        WRITE(GCHN.120)
120     FORMAT(" ","!COL C0 C7")
        DO 140 I=1.NDP
        READ(PFILE.18) (IDATA(J).J=1.39)
18      FORMAT(39A2)
        WRITE(GCHN.35) (IDATA(J).J=1.39)
35      FORMAT(" ".39A2)
140     CONTINUE
C
C       DISPLAY RAMP METERING ARROW (TRUE=RED   FALSE=GREEN)
C
        DO 150 I=M.N
        IF(RMETER(I)) WRITE(GCHN.300)
        IF(.NOT. RMETER(I)) WRITE(GCHN.310)!      FALSE IMPLIES NOT METERED
        READ(PFILE.18) (IDATA(J).J=1.39)
        WRITE(GCHN.35) (IDATA(J).J=1.39)
150     CONTINUE
C
C       DISPLAY ANY ADDITIONAL DATA
C
5       READ(PFILE.18.END=99) (IDATA(I).I=1.39)
        WRITE(GCHN.35) (IDATA(I).I=1.39)
        GOTO 5
310     FORMAT(" ","!COL C2 C7")
300     FORMAT(" ","!COL C1 C7")
C
99      RETURN
        END
```

```
C
      OVERLAY OREQEW
      SUBROUTINE REQEW
C
C  FUNCTION: THIS ROUTINE READS THE QEWDYN DATA FILE AND PASSES THF
C                 DATA BACK TO THE MAIN GRAPHIC PROGRAM.
C
C  CALLED BY:TASK GMAP
C
      COMMON/SCREEN/GCHN,PFILE,RQEW,RWTEMP
      COMMON/NWREC/KL30S,NWREC,KINC,KSM,NALREC,KDISP
      COMMON/QEWDATA/QEW
C
      INTEGER GCHN,PFILE,RQEW,RWTEMP
      INTEGER KL30S,NWREC,KINC,KSM,NALREC,KDISP
      INTEGER QEW(512),SREC
C
      SREC=KDISP-8
      CALL OPEN(RQEW,"QEWDYN",1,IER,2*64)
      CALL READR(RQEW,SREC,QEW(1),8,IER)
      CALL CLOSE(RQEW,IER)
C
      RETURN
      END
```

```
C
      SUBROUTINE SLCHEK(VOL,OCC,AEL,WVE,IJ)
C
      COMMON/LIMITS/MAXOCC,MAXSPD,IMIN,MAXVEH,STOLN,S1,S2
      COMMON/ST1S/LATST,ERHARD
      COMMON/RANGE/UPRNGE(113,2),DNRNGE(67,3)
C
      INTEGER MAXOCC,MAXSPD,IMIN,MAXVEH,STDLN,S1,S2
      INTEGER LATST,ERHARD
      INTEGER UPRNGE,DNRNGE
      INTEGER VOL,OCC,AEL,WVE,IJ,IROW
C
C
      IROW=1
      IF(VOL.GT.MAXVEH.OR.VOL.LT.0)GOTO 120 ;VOL OUT OF RANGE
      IF(OCC.LT.0)GOTO 130 ;OCC OUT OF RANGE
      IF(OCC.GT.MAXOCC)OCC=MAXOCC
      IF(VOL.EQ.0.AND.OCC.EQ.0)WVE=1
      AEL=AEL+OCC ;ACC EL TIME
      IF(VOL.EQ.0)GO TO 999
C
      IF(AEL.GE.(VOL*IMIN))GOTO 100
      IROW=2
120   UPRNGE(IJ,IROW)=UPRNGE(IJ,IROW)+1;INC OUT-OF-RANGE COUNTS
130   ERHARD=ERHARD+1 ;INC ERROR COUNTS
      VOL=0
      OCC=0
100   AEL=0
C
999   RETURN
      END
      OVERLAY OSPD1
      SUBROUTINE SPD1
C
C
C FUNCTION : DETERMINE WHAT COLOUR TO PAINT THE LANES BASED UPON
C         C1=RED  C2=GREEN  C3=BLUE  C4=YELLOW  C5=ORANGE
C            THE 1 MINUTE MAINLANE DATA, ACCORDING TO SPEED.
C
C
      COMMON/QEWDATA/QEW
      COMMON/SCREEN/GCHN,PFILE,RQEW,RWTEMP
      COMMON/OPTA/ISDL,ISCL,ISPL
      COMMON/WORDS/NSTA,NCON,IS,IV,IO,RO,RV,TXT,K,K1
      INTEGER NSTA,NCON,IS,IV,IO,RO,RV,TXT(6),K,K1,IDATA(39)
      INTEGER QEW(512),GCHN,PFILE,PQEW,RWTEMP
C
C     TEST SPEED ON PASSING LANE
C
      IF(QEW(ISPL) .GT. 100) WRITE(GCHN,300)
      IF(QEW(ISPL) .GE. 80 .AND. QEW(ISPL) .LE. 100) WRITE(GCHN,200)
      IF(QEW(ISPL) .GE. 60 .AND. QEW(ISPL) .LT. 80) WRITE(GCHN,400)
      IF(QEW(ISPL) .GE. 40 .AND. QEW(ISPL) .LT. 60) WRITE(GCHN,500)
      IF(QEW(ISPL) .LT. 40) WRITE(GCHN,100)
      IF(QEW(ISPL) .LT. 0) WRITE(GCHN,800)
C
C     PAINT PASSING LANE
C
900   READ(PFILE,18) (IDATA(I),I=1,39)
      WRITE(GCHN,35) (IDATA(I),I=1,39)
      KK=ISHFT(IDATA(39),8)+46K
      IF(KK .EQ. K .OR. IDATA(37) .EQ. K1) GOTO 900
C
C     TEST SPEED ON CENTRE LANE
C
      IF(QEW(ISCL) .GT. 100) WRITE(GCHN,300)
      IF(QEW(ISCL) .GE. 80 .AND. QEW(ISCL) .LE. 100) WRITE(GCHN,200)
      IF(QEW(ISCL) .GE. 60 .AND.QEW(ISCL) .LT. 80) WRITE(GCHN,400)
      IF(QEW(ISCL) .GE. 40 .AND. QEW(ISCL) .LT. 60) WRITE(GCHN,500)
      IF(QEW(ISCL) .LT. 40) WRITE(GCHN,100)
      IF(QEW(ISCL) .LT. 0) WRITE(GCHN,800)
C
C       PAINT CENTRE LANE
C
1000  READ(PFILE,18) (IDATA(I),I=1,39)
      WRITE(GCHN,35) (IDATA(I),I=1,39)
      KK=ISHFT(IDATA(39),8)+46K
      IF(KK .EQ. K .OR. IDATA(37) .EQ. K1) GOTO 1000
      RETURN
18    FORMAT(39A2)
35    FORMAT(" ",39A2)
100   FORMAT(" ","!COL C1 CO")
200   FORMAT(" ","!COL C2 CO")
400   FORMAT(" ","!COL C4 CO")
500   FORMAT(" ","!COL C5 CO")
300   FORMAT(" ","!COL C3 CO")
800   FORMAT(" ","!COL C7 CO")
      END
      OVERLAY OSPD2
      SUBROUTINE SPD2
C
C
C FUNCTION : TO PAINT DRIVING LANES AND EXTRA LANE ON WINSTON CHURCHILL
C            BASED UPON SPEED.
C
C
C
      COMMON/GRAPH/MAPNUM,LMAP
      COMMON/QEWDATA/QEW
      COMMON/SCREEN/GCHN,PFILE,RQEW,RWTEMP
      COMMON/UPTA/ISDL,ISCL,,ISPL
      COMMON/EXTRA/WINSTON
      COMMON/WORDS/NSTA,NCON,IS,IV,IO,RO,RV,TXT,K,K1
      LOGICAL WINSTON
      INTEGER NSTA,NCON,IS,IV,IO,RO,RV,TXT(6),K,K1
      INTEGER QEW(512),GCHN,PFILE,RQEW,RWTEMP,LMAP,MAPNUM,IDATA(39)
C
C     TEST SPEED ON DRIVING LANE
C
      IF(QEW(ISDL) .GT. 100) WRITE(GCHN,300)
      IF(QEW(ISDL) .GE. 80 .AND. QEW(ISDL) .LE. 100) WRITE(GCHN,200)
      IF(QEW(ISDL) .GE. 60 .AND. QEW(ISDL) .LT. 80) WRITE(GCHN,400)
      IF(QEW(ISDL) .GE. 40 .AND. QEW(ISDL) .LT. 60) WRITE(GCHN,500)
      IF(QEW(ISDL) .LT. 40) WRITE(GCHN,100)
      IF(QEW(ISDL) .LT. 0) WRITE(GCHN,800)
C
C       PAINT DRIVING LANE
C
900   READ(PFILE,18) (IDATA(I),I=1,39)
      WRITE(GCHN,35) (IDATA(I),I=1,39)
      KK=ISHFT(IDATA(39),8)+46K
      IF(KK .EQ. K .OR. IDATA(37) .EQ. K1) GOTO 900
      IF(MAPNUM .NE. 3) RETURN
      IF(WINSTON) RETURN
C
C     TEST SPEED ON WINSTON EXTRA LANE
C
      ISEL=412
      IF(QEW(ISEL) .GT. 100) WRITE(GCHN,300)
      IF(QEW(ISEL) .GE. 80 .AND. QEW(ISEL) .LE. 100) WRITE(GCHN,200)
      IF(QEW(ISEL) .GE. 60 .AND. QEW(ISEL) .LT. 80) WRITE(GCHN,400)
      IF(QEW(ISEL) .GE. 40 .AND.QEW(ISEL) .LT. 60)WRITE(GCHN,500)
      IF(QEW(ISEL) .LT. 40) WRITE(GCHN,100)
      IF(QEW(ISEL) .LT. 0) WRITE(GCHN,800)
C
C       PAINT EXTRA LANE
C
      READ(PFILE,18) (IDATA(I),I=1,39)
      WRITE(GCHN,35) (IDATA(I),I=1,39)
C
C     SET WINSTON=.TRUE. AFTER PAINTING EXTRA LANE
C
      WINSTON=.TRUE.
      RETURN
18    FORMAT(39A2)
35    FORMAT(" ",39A2)
100   FORMAT(" ","ICOL C1 C0")
200   FORMAT(" ","ICOL C2 C0")
400   FORMAT(" ","ICOL C4 C0")
500   FORMAT(" ","ICOL C5 C0")
300   FORMAT(" ","ICOL C3 C0")
800   FORMAT(" ","ICOL C7 C0")
      END
```

```
C
      SUBROUTINE TOPCOM
C
C
C     THIS ROUTINE PROVIDES THE OPERATOR COMMANDS.
C
C
      EXTERNAL OINPEDIT.OT12A.OT12B.OT13.
     *   OT14A.OT14B.OT14C.OT14D.OT15.
     *   OT16A.OT16B.OT16C.OT16D.OT17A.OT17B.
     *   OT18A.OT18B.OT18C.OT18D
C
      COMMON/BLOK?/FT140
C
      INTEGER COMAND.COM1.COM2.ICODE(30).INUM(0:30).ICHAR(60)
      INTEGER FT140
C
C
C
      CALL PRI (7)
      CALL OVOPN (13.'QEW.OL'.IER)
C
      INUM(0)=0
      ICOUNT=30
      ICHCNT=60
      NVAR=30
C
3     CONTINUE
      WRITE(10.103)
103   FORMAT('0'. 'QEW')
      GO TO 4
C
4     CONTINUE
      WRITE(10.101)
101   FORMAT(' '. '>'. Z)
      READ(11.102)COM1.COM2 ;COMMAND GROUP
102   FORMAT(2A2)
C
      IF(COM2.EQ.'  ')GO TO 30
      IF(COM1.EQ.'CM'.AND.COM2.EQ.'S ')GO TO 10
      IF(COM1.EQ.'IN'.AND.COM2.EQ.'F ')GO TO 10
      IF(COM1.NE.'JC'.OR.COM2.NE.'W ')GO TO 1
10    COMAND=ISHFT(COM2.-8).AND.7
      GO TO 1000
C
30    IF(COM1.EQ.'RC')GO TO 50
      IF(COM1.EQ.'QU')GO TO 50
      IF(COM1.EQ.'G ')GO TO 50
      IF(COM1.EQ.'H ')GO TO 50
      IF(COM1.EQ.'  ')GO TO 3
1     TYPE "INVALID COMMAND GROUP!"
      GO TO 4
C
50    COMAND=(ISHFT(COM1.-8).AND.000016K)/2+1
1000  CALL FOVLD(13.OINPEDIT.0.IER)
      CALL INPEDIT(ICODE,INUM,ICHAR,NVAR,ICOUNT,ICHCNT.COM1.COM2)
      CALL FOVRL(OINPEDIT,IER)
      IF(ICODE(1).EQ.2)GO TO 85
      TYPE "COMMAND NOT AUTHORIZED!"
      GO TO 1000
C
85    IF(ICHAR(1).NE.'E ')GO TO 90 ; EXIT COMMAND GROUP
      IF(ICHAR(2).NE.'  ')GO TO 90
      IF(NVAR.EQ.1)GO TO 3
C
90    GO TO(200,100,300,400,600,500,700).COMAND
C
C
C     'RC' COMMAND GROUP
C
C
100   CALL FOVLD(13,OT12A,0,IER)
      CALL T12A(ICODE,INUM,ICHAR,NVAR,ICOUNT,ICHCNT,IFLAG)
      CALL FOVRL(OT12A.IER)
      IF(IFLAG.EQ.1)GO TO 1000
      CALL FOVLD(13,OT12B,0,IER)
      CALL T12B(INUM,ICOUNT.ICHCNT)
      CALL FOVRL(OT12B,IER)
      GO TO 1000
C
C
C     'QU' COMMAND GROUP
C
C
200   CALL FOVLD(13,OT13,0,IER)
```

```
      CALL T13(ICODE,INUM,ICHAR,NVAR,ICOUNT,ICHCNT)
      CALL FOVRL(OT13,IER)
      GO TO 1000
C
C
C     'CMS' COMMAND GROUP
C
C
300   CALL FOVLD(13,OT14A,0,IER)
      CALL T14A(ICODE,ICHAR,NVAR,ICHCNT,IFLAG)
      CALL FOVRL(OT14A,IER)
      GO TO(1000,310,320),IFLAG
310   CALL FOVLD(13,OT14B,0,IER)
      CALL T14B(ICODE,INUM,ICHAR,NVAR,ICOUNT,ICHCNT)
      CALL FOVRL(OT14B,IER)
      GO TO 1000
320   CALL FOVLD(13,OT14C,0,IER)
      CALL T14C(ICODE,INUM,ICHAR,NVAR,ICOUNT,ICHCNT)
      CALL FOVRL(OT14C,IER)
      CALL FOVLD(13,OT14D,0,IER)
      CALL T14D (INUM,ICOUNT)
      CALL FOVRL(OT14D,IER)
      GO TO 1000
C
C
C     'G' COMMAND GROUP
C
C
400   CALL FOVLD(13,OT15,0,IER)
      CALL T15(ICHAR,ICHCNT,NVAR)
      CALL FOVRL(OT15,IER)
      GO TO 1000
C
C
C     'INF' COMMAND GROUP
C
C
500   CALL FOVLD(13,OT16A,0,IER)
      CALL T16A(INUM,ICHAR,ICOUNT,ICHCNT,IFLAG)
      CALL FOVRL(OT16A,IER)
      GO TO(510,510,520,1000,530,530,520),IFLAG
510   CALL FOVLD(13,OT16B,0,IER)
      CALL T16B(INUM,ICOUNT,IFLAG)
      CALL FOVRL(OT16B,IER)
      GO TO 1000
520   CALL FOVLD(13,OT16C,0,IER)
      CALL T16C(INUM,ICOUNT,IFLAG)
      CALL FOVRL(OT16C,IER)
      GO TO 1000
530   CALL FOVLD(13,OT16D,0,IER)
      CALL T16D(INUM,ICOUNT,IFLAG)
      CALL FOVRL(OT16D,IER)
      GO TO 1000
C
C
C     'H' COMMAND GROUP
C
C
600   CALL FOVLD(13,OT17A,0,IER)
      CALL T17A(ICODE,INUM,ICHAR,NVAR,ICOUNT,ICHCNT,IFLAG)
      CALL FOVRL(OT17A,IER)
      IF(IFLAG.EQ.7)GO TO 1000
      CALL FOVLD(13,OT17B,0,IER)
      ICOUNT=2
      CALL T17B(INUM,ICOUNT,IFLAG)
      CALL FOVRL(OT17B,IER)
      GO TO 1000
C
C
C     'JCW' COMMAND GROUP
C
C
700   CALL FOVLD(13,OT18A,0,IER)
      CALL T18A(ICODE,INUM,ICHAR,NVAR,ICOUNT,ICHCNT,IFLAG)
      CALL FOVRL(OT18A,IER)
      IF(IFLAG.EQ.0)GO TO 1000
      IF(IFLAG.EQ.6)GO TO 710
      CALL FOVLD(13,OT18B,0,IER)
      CALL T18B(INUM,ICOUNT,IFLAG)
      CALL FOVRL(OT18B,IER)
      GO TO 1000
710   CALL FOVLD(13,OT18C,0,IER)
      CALL T18C
      CALL FOVRL(OT18C,IER)
      CALL FOVLD(13,OT18D,0,IER)
      CALL T18D
      CALL FUVRL(DT18D,IER)
C
      CALL CLOSE (13,IER)
C
      RETURN
      END
```

```
C
        TASK TRANSF
C
C
C
C
C       A THIRTY-SECOND PERIODIC FREEWAY TRAFFIC SURVEILLANCE
C         AND CONTROL TASK. INCLUDING INCIDENT DETECTION
C         AND RAMP CONTROL.
C
        EXTERNAL OWOOD30.OUPD30S.OINCDET.OPERCHK
        EXTERNAL ODATSTR.OCLOU.OVTLU.ORCTIME.OQUOCC
        EXTERNAL OALM30S.OALM5M,ODIS1,ODYS1.ODIS2.OAMODM
C
        COMMON/TC/IMIN10
        COMMON/ICNT/COUNT,KCNTSM,IMIN5,KCOUNT
        COMMON/ALARM/NOBEEP,ALMBEEP
        COMMON/INCB/OCCOBI(21),OCCUBI(21),INCNT(21),INCONT.INCEX
        COMMON/TSKSYN/TSK0.TSK1,TSK2,TSK3
        COMMON/WKDAY/HMS(3),MDY(3)
        COMMON/SCREEN/GCHN.PFILE.RQEW,RWTEMP
C
        INTEGER IMIN10
        INTEGER COUNT,KCNTSM,IMIN5.KCOUNT
        INTEGER NOBEEP,ALMBEEP
        INTEGER OCCOBI,OCCUBI,INCNT,INCONT.INCEX
        INTEGER TSK0,TSK1,TSK2,TSK3
        INTEGER HMS.MDY
        INTEGER GCHN.PFILE.RQEW.RWTEMP
C
900     CONTINUE
        CALL REC(TSK1,MD1)
C
        CALL TIME (HMS(1).IER)
        CALL DATE (MDY(1).IER)
C
        CALL FOVLD(1,OWOOD30,0.IER)
        CALL WOOD30
        CALL FOVRL(OWOOD30.IER)
C
        CALL FOVLD(1,OUPD30S,0.IER)
        CALL UPD30S
        CALL FOVRL(OUPD30S.IER)
C
        IF(INCEX.EQ.0)GO TO 100
C
        CALL FOVLD(1,OINCDET.0.IER)
        CALL INCDET
        CALL FOVRL(OINCDET.IER)
C
        CALL FOVLD(1,OPERCHK,0.IER)
        CALL PERCHK
        CALL FOVRL(OPERCHK.IER)
C
        CALL FOVLD(1,ODATSTR,0,IER)
        CALL DATSTR
        CALL FOVRL(ODATSTR.IER)
C
        CALL FOVLD(1,OCLOU,0.IER)
        CALL CLOU
        CALL FOVRL(OCLOU.IER)
C
        CALL FOVLD(1,OVTLU,0.IER)
        CALL VTLU
        CALL FOVRL(OVTLU.IER)
C
100     INCEX=1
C
        CALL FOVLD(1,ORCTIME,0.IER)
        CALL RCTIME
        CALL FOVRL(ORCTIME.IER)
C
        CALL FOVLD(1,OQUOCC,0,IER)
        CALL QUOCC
        CALL FOVRL(OQUOCC.IER)
C
        CALL FOVLD(1,OALM30S,0.IER)
        CALL ALM30S
        CALL FOVRL(OALM30S,IER)
C
        IF(IMINS.EQ.0)GO TO 800
        IMINS=0 ;5 MINS ALR.,RESET COUNT
C
        CALL FOVLD(1,OALM5M,0.IER)
        CALL ALM5M
        CALL FOVRL(OALM5M,IER)
```

```
C
          IMIN10=IMIN10+1
          IF(IMIN10.NE.2)GO TO 800
          IMIN10=0
C
          CALL FOVLD(1,OAMODM,0,IER)
          CALL AMODM
          CALL FOVRL(OAMODM,IER)
C
800       CALL FOVLD(1,ODIS1,0,IER)
          CALL DIS1
          CALL FOVRL(ODIS1,IER)
C
          CALL FOVLD(1,ODYS1,0,IER)
          CALL DYS1
          CALL FOVRL(ODYS1,IER)
C
          IGO=MOD(KCOUNT,2)
          IF(IGO.EQ.1)GO TO 850             ;NOT END OF MIN YET
C
C
          CALL FOVLD(1,ODIS2,0,IER)
          CALL DIS2
          CALL FOVRL(ODIS2,IER)
C
          CALL XMT (TSK2,1,$1000)
850       IF(NOBEEP.LE.0.AND.ALMBEEP.GT.0)
     *      WRITE (10, 860)
860       FORMAT (' <007>', Z)
          IF (NOBEEP.LE. 0.AND.INCONT.GT. 0)
     *      WRITE (GCHN) ' <007>'
          GO TO 900
C
1000      TYPE "IN TASK 'TRANSF', XMT ERROR TO TASK 'GMAP': TSK2 =", TSK2
          CALL STTSK (40, ISTGMA, IER)
          TYPE "STTSK IER =", IER, ", GMAP STATUS =", ISTGMA
C
          END
```

```
C
        OVERLAY OT12A
        SUBROUTINE T12A (ICODE,INUM,ICHAR,NVAR,ICOUNT,ICHCNT,FLAG)
C
        COMMON/CTRL1/CONTRL,MAXCYC,METER(10),MODCYC(10)
        COMMON/CTRL2/CYCOVR(10),RAMCYC(10)
        COMMON/CTRL5/THRCP(4),CTRMOD
C
        INTEGER ICODE(NVAR),INUM(0:ICOUNT),ICHAR(ICHCNT)
        INTEGER CYCOVR,RAMCYC,THRCP,CTRMOD,FLAG,CONTRL
C
C
C
        FLAG=1
        IF(ICHAR(2).NE.'  ')GOTO 1
        IF(ICHAR(1).EQ.'C ')GOTO 100
        IF(ICHAR(1).EQ.'P ')GOTO 200
        IF(ICHAR(1).EQ.'T ')GOTO 300
        IF(ICHAR(1).EQ.'R ')GOTO 400
1       TYPE "COMMAND NOT AUTHORIZED!"
        GOTO 1000
2       TYPE "DATA ERROR."
        GOTO 1000
C       COMMAND : C
100     IF(NVAR.EQ.1)GOTO 130
        IF(ICHCNT.NE.4)GOTO 1
        IF(ICOUNT.LT.2)GOTO 1
        IF(ICHAR(3).NE.'M ')GOTO 1
        IF(ICODE(NVAR-1).NE.2)GOTO 1
        IF(INUM(ICOUNT).GT.20)GOTO 2
        J=ICOUNT-1
        DO 110 I=1,J
        IF(INUM(I).LT.1)GOTO 2
        IF(INUM(I).GT.10)GOTO 2
110     CONTINUE
        DO 120 I=1,J
120     CYCOVR(INUM(I))=INUM(ICOUNT)
        GOTO 1000
130     WRITE(10,135)CYCOVR
135     FORMAT(' ',10I4)
        GOTO 1000
C       COMMAND : P
200     IF(NVAR.EQ.1)GOTO 210
        IF(NVAR.NE.2)GOTO 1
        IF(ICOUNT.NE.1)GOTO 1
        IF(INUM(1).GT.4)GOTO 2
        CTRMOD=INUM(1)
        GOTO 1000
210     IF(CTRMOD.EQ.4)GOTO 220
        WRITE(10,215)CTRMOD
215     FORMAT(' ','PRESENT CP=',I1,', MANUAL.')
        GOTO 1000
220     WRITE(10,225)CONTRL
225     FORMAT(' ','PRESENT CP=',I1,',AUTO ADVANCEMENT.')
        GOTO 1000
C       COMMAND : T
300     IF(NVAR.EQ.1)GOTO 330
        IF(NVAR.NE.5)GOTO 1
        IF(ICOUNT.NE.4)GOTO 1
        DO 310 I=1,4
        IF(INUM(I).GE.2400)GOTO 2
        IF(MOD(INUM(I),100).GT.59)GOTO 2
        IF(INUM(I-1).GT.INUM(I))GOTO 2
310     CONTINUE
        DO 320 I=1,4
320     THRCP(I)=INUM(I)
        GOTO 1000
330     WRITE(10,340)THRCP
340     FORMAT(/1X,'CP START TIME: ',4(I4,2X))
        GOTO 1000
C       COMMAND : R
400     FLAG=2
C
1000    RETURN
        END
```

```
C
        OVERLAY OT128
        SUBROUTINE T128 (INUM,ICOUNT,ICHCNT)
C
        INTEGER INUM(0:ICOUNT),ICHCNT
        INTEGER DUMMY(50)
C
C
C
        IF(ICHCNT.NE.2)GOTO 1
        IF(ICOUNT.LT.1)GOTO 1
        IF(INUM(1).EQ.0)GOTO 2
        IF(INUM(1).GT.3)GOTO 2
        ISUB=INUM(1)
        GOTO(100,200,300),ISUB
100     CALL OPEN(6,"RAMTAB",1,IER,2*40)
        CALL READR(6,1,DUMMY,1,IER)
        IF(ICOUNT.NE.1)GOTO 110
        WRITE(10,105)(DUMMY(I),I=1,40)
105     FORMAT(/1X,'RAMTAB:',10(/1X,4I6))
        GOTO 1000
110     MAXVAR=7 ; MAXIMUM # OF VARIABLES
        MAXNUM=10 ; NUMBER OF ROWS
        ICOL=4 ; NUMBER OF COLUMNS
        GOTO 400
200     CALL OPEN(6,"CYCTAB",1,IER,2*25)
        CALL READR(6,1,DUMMY,1,IER)
        IF(ICOUNT.NE.1)GOTO 210
        WRITE(10,205)(DUMMY(I),I=1,25)
205     FORMAT(/1X,'CYCTAB:',5(/1X,5I6))
        GOTO 1000
210     MAXVAR=8
        MAXNUM=5
        ICOL=5
        GOTO 400
300     CALL OPEN(6,"CYCLES",1,IER,2*50)
        CALL READR(6,1,DUMMY,1,IER)
        IF(ICOUNT.NE.1)GOTO 310
        WRITE(10,305)(DUMMY(I),I=1,50)
305     FORMAT(/1X,'CYCLES:',10(/1X,5I6))
        GOTO 1000
310     MAXVAR=8
        MAXNUM=10
        ICOL=5
400     IF(NVAR.NE.MAXVAR)GOTO 1
        IF(INUM(2).GT.MAXNUM)GOTO 2
        IF(INUM(2).EQ.0)GOTO 2
        J=INUM(2)*ICOL-ICOL
        DO 410 I=1,ICOL
410     DUMMY(I+J)=INUM(I+2)
        CALL WRITR(6,1,DUMMY,1,IER)
        GOTO 1000
1       TYPE "COMMAND NOT AUTHORIZED!"
        GOTO 1000
2       TYPE "DATA ERROR."
        GOTO 1000
1000    CALL CLOSE(6,IER)
C
        RETURN
        END
```

```
C
        OVERLAY OT13
        SUBROUTINE T13 (ICODE,INUM,ICHAR,NVAR,ICOUNT,ICHCNT)
C
        COMMON/Q01/QOVR(10),QIND(10)
        COMMON/Q02/QWAIT(10),QLNTH(10)
        COMMON/Q03/KQCNT(10),KSTEP(10),KTLMT(10),KTHR
        COMMON/Q04/QOCCLB(10),QOCCUB(10)
        COMMON/QOC/QOCC(13)
        COMMON/CTRL1/CONTRL,MAXCYC,METER(10),MODCYC(10)
C
        INTEGER ICODE(NVAR),INUM(0:ICOUNT),ICHAR(ICHCNT)
        INTEGER OUTBUF(74),QOVR,QIND,QWAIT,QLNTH,KQCNT,KSTEP,KTLMT,KTHR
        INTEGER QOCCLB,QOCCUB,QOCC,CONTRL,MAXCYC,METER,MODCYC
C
C
C
        IF(ICHAR(2).NE.'  ')GOTO 1
        IF(ICHAR(1).EQ.'D ')GOTO 100
        IF(ICHAR(1).EQ.'N ')GOTO 100
        IF(ICHAR(1).EQ.'U ')GOTO 300
        IF(ICHAR(1).EQ.'L ')GOTO 300
        IF(ICHAR(1).EQ.'T ')GOTO 500
        IF(ICHAR(1).EQ.'P ')GOTO 600
1       TYPE "COMMAND NOT AUTHORIZED!"
        GOTO 1000
2       TYPE "DATA ERROR."
        GOTO 1000
C       COMMAND : D AND N
100     IF(NVAR.NE.2)GOTO 1
        IF(ICODE(2).NE.1)GOTO 1
        IF(INUM(1).LT.1)GOTO 2
        IF(INUM(1).GT.10)GOTO 2
        QOVR(INUM(1))=(.NOT.ICHAR(1).AND.1000K)/1000K  : 1 OR 0
        GOTO 1000
C       COMMAND : U AND L
300     IF(NVAR.NE.11)GOTO 1
        IF(ICOUNT.NE.10)GOTO 1
        DO 320 I=1,10
        IF(ICHAR(1).EQ.'L ')GOTO 312
        QOCCUB(I)=INUM(I)
        GOTO 320
312     QOCCLB(I)=INUM(I)
320     CONTINUE
        GOTO 1000
C       COMMAND : T
500     IF(NVAR.NE.13)GOTO 1
        IF(ICHCNT.NE.4)GOTO 1
        IF(ICODE(2).NE.1)GOTO 1
        IF(ICHAR(3).NE.'S ')GOTO 1
        IF(ICHAR(4).NE.'  ')GOTO 1
        DO 510 I=4,11
        IF(ICODE(I).NE.1)GOTO 1
510     CONTINUE
        DO 520 I=1,10
520     KSTEP(I)=INUM(I+1)
        KTHR=INUM(1)*2
        GOTO 1000
C       COMMAND : P
600     IF(NVAR.NE.1)GOTO 1
        DO 610 I=1,10
        OUTBUF(I)=MODCYC(I)
        OUTBUF(I+10)=QWAIT(I)
        OUTBUF(I+20)=QOVR(I)
        OUTBUF(I+30)=QOCCLB(I)
        OUTBUF(I+40)=QOCCUB(I)
        OUTBUF(I+50)=KSTEP(I)
610     OUTBUF(I+60)=QOCC(I)
        DO 620 I=11,13
620     OUTBUF(I+60)=QOCC(I)
        OUTBUF(74)=(KTHR+1)/2 : ROUND OFF
        WRITE(10,625)(I,I=1,9),OUTBUF
625     FORMAT(/1X,'RAMPS:',//8X,9(2X,'NO.',I1),2X,'NO.10',//1X,'MODCYC ',
     +  10I6,//1X,'QWAIT   ',10I6,//1X,'QOVR    ',10I6,//1X,
     +  'QOCCLB  ',10I6,//1X,'QOCCUB  ',10I6,//1X,'KSTEP   ',
     +  10I6,//1X,'QOCC',4X,13I5,//1X,'KTHR(MIN.)=',I6)
C
1000    RETURN
        END
```

```
C
        OVERLAY OT14A
        SUBROUTINE T14A (ICODE,ICHAR,NVAR,ICHCNT,FLAG)
C
        COMMON/SGN1/XMTBUF(45),RCVBUF(45),SGNADR(2)
        COMMON/SGN2/NWORDS,BUFSIZ,NMSGTX,NMSGRX,MTLSGN(2)
C
        INTEGER XMTBUF,RCVBUF,SGNADR,ICODE(NVAR),ICHAR(ICHCNT)
        INTEGER MSGBUF(45),BUFSIZ,FLAG,PARBUF(128)
C
C
C
        FLAG=1
        IF(ICHAR(2).NE.'  ')GO TO 1
        IF(ICHAR(1).EQ.'A ')GO TO 100
        IF(ICHAR(1).EQ.'D ')GO TO 5
        IF(ICHAR(1).EQ.'L ')GO TO 5
        IF(ICHAR(1).EQ.'B ')GO TO 5
        IF(ICHAR(1).EQ.'P ')GO TO 5
        IF(ICHAR(1).NE.'S ')GO TO 1
        FLAG=3
        GO TO 1000
C
5       FLAG=2
        GO TO 1000
C
1       TYPE "COMMAND NOT AUTHORIZED!"
        GO TO 1000
C
100     IF(NVAR.NE.1)GO TO 1
C
C       'A' COMMAND
C
        CALL OPEN(6,"MSGFILE",1,IER,2*45)
        CALL READR(6,1,MSGBUF(1),1,IER)
        NMAX=MSGBUF(1)   !POSITION OF LAST RECORD
        NEXT=MSGBUF(2)   !POSITION OF 1ST EMPTY RECORD
        N1=NEXT
110     IF(N1.GT.NMAX)GO TO 120
        CALL READR(6,N1,MSGBUF(1),1,IER)
        IF(MSGBUF(1).EQ.-1)GO TO 130   !-1 SIGNIFIES EMPTY RECORD
        N1=N1+1
        GO TO 110
120     NMAX=NMAX+1
130     NEXT=N1+1
        CALL CLOSE(6,IER)
C
140     TYPE 'ROW1,CH,ROW2,CH','<15>','1234567890123456789012'
        READ(11,145)(MSGBUF(I),I=3,13)
145     FORMAT(11A2)
        READ(11,145)(MSGBUF(I),I=15,25)
        WRITE(10,148)
148     FORMAT(' ','OK?  TYPE Y OR N >', Z)
        READ(11,149)IN
149     FORMAT(A1)
        IF(IN.EQ.'N ')GO TO 140
C
        MSGBUF(1)=000044K         !NUL (000K) / ADDRESS (044K)
        MSGBUF(2)=000407K         !SOH (001K) / BEL (007K)
        MSGBUF(14)=006412K        !CR  (015K) / LF (012K)
        MSGBUF(26)=001400K        !ETX (003K) / NUL (000K)
C
        CALL OPEN(6,"PARTAB",1,IER,2*128)
        CALL READR(6,1,PARBUF(1),1,IER)
        CALL CLOSE(6,IER)
C
C       SET EVEN PARITY FOR MESSAGE HEADER AND TEXT
C
        DO 160 I=2,NWORDS         !NWORDS=26
        IBYTE=MSGBUF(I)
        ILFT=ISHFT(IBYTE,-8)
        ILFT=PARBUF(ILFT+1)
        IRIT=IBYTE.AND.000377K
        IRIT=PARBUF(IRIT+1)
        MSGBUF(I)=ISHFT(ILFT,8) .OR. IRIT
160     CONTINUE
C
        DO 170 I=27,45
170     MSGBUF(I)=000000K         !NUL (000K) / NUL (000K)
C
        CALL OPEN(6,"MSGFILE",2,IER,2*45)
        CALL WRITR(6,N1,MSGBUF(1),1,IER)
        N1=N1-2
        WRITE(10,175)N1,(MSGBUF(I),I=3,13),(MSGBUF(I),I=15,25)
175     FORMAT(' ','MESSAGE #',I2,':', 2(/1X,11A2))
```

```
      CALL READR(6,1,MSGBUF(1),1,IER)
      MSGBUF(1)=NMAX
      MSGBUF(2)=NEXT
      CALL WRITR(6,1,MSGBUF(1),1,IER)
      CALL CLOSE(6,IER)
C
1000  RETURN
      END
```

```
C
        OVERLAY OT14B
        SUBROUTINE T14B (ICODE,INUM,ICHAR,NVAR,ICOUNT,ICHCNT)
C
C
        COMMON/SGN1/XMTBUF(45),RCVBUF(45),SGNADR(2)
        COMMON/SGN2/NWORDS,BUFSIZ,NMSGTX,NMSGRX,MLTSGN(2)
C
        INTEGER ICODE(NVAR),INUM(0:ICOUNT),ICHAR(ICHCNT)
        INTEGER XMTBUF,RCVBUF,SGNADR
        INTEGER NWORDS,BUFSIZ,NMSGTX,NMSGRX,MLTSGN
        INTEGER MSGBUF(45)
C
C
C
        IC=ICHAR(1)
        IF (IC.NE.'B ' .AND. IC.NE.'L ') GO TO 300
C
C       'B' AND 'L' COMMANDS
C
        IF(NVAR.NE.1)GO TO 950
        IF(NMSGTX.GT.0)GO TO 100
        TYPE "NO MESSAGES TRANSMITTED"
        GO TO 1000
100     IF (IC.NE.'B ') GO TO 200
C
C       'B' COMMAND
C
        TYPE "TRANSMIT MESSAGE:"
        IF(XMTBUF(2).NE.1280)GO TO 110
        TYPE "'ENQ'"
        GO TO 120
110     WRITE BINARY (10) (XMTBUF(I),I=3,25),XMTBUF(14)
120     TYPE "RECEIVE MESSAGE:"
        IF(NMSGRX.NE.0)GO TO 130
        TYPE "NO MESSAGES RECEIVED"
        GO TO 1000
130     IF(RCVBUF(2).NE.1280)GO TO 140
        TYPE "'ENQ'"
        GO TO 1000
140     WRITE BINARY (10) (RCVBUF(I),I=3,25),RCVBUF(14)
        GO TO 1000
C
C       'L' COMMAND
C
200     CALL OPEN(6,"XMTTAB",1,IER,2*45)
        DO 240 I=1,2
        K=0
        WRITE(10,215)I
215     FORMAT(' CMS ',I1)
        DO 238 N=1,NMSGTX
        CALL READR(6,N,MSGBUF(1),1,IER)
        CALL ICLR(MSGBUF(7),7)
        IF(MSGBUF(7).NE.SGNADR(I))GO TO 238
        K=K+1
        IF(MSGBUF(8).EQ.1280)GO TO 230
        WRITE(10,225)(MSGBUF(L),L=4,6),(MSGBUF(L),L=9,19),(MSGBUF(L),L=21,31)
225     FORMAT(/1X,I2,2(':',I2),'-', 2(/1X,11A2))
        GO TO 232
230     WRITE(10,231)(MSGBUF(L),L=4,6)
231     FORMAT(/1X,I2,2(':',I2),//" 'ENQ'")
232     IF(K.EQ.NMSGTX)GO TO 900
238     CONTINUE
        IF(K.EQ.0)TYPE "NO MESSAGES TO CMS"
240     CONTINUE
        GO TO 900
C
300     IF (IC.NE.'D ' .AND. IC.NE.'P ') GO TO 950
C
C       'D' AND 'P' COMMANDS
C
        CALL OPEN(6,"MSGFILE",2,IER,2*45)
        CALL READR(6,1,MSGBUF(1),1,IER)
        NMAX=MSGBUF(1)
        NEXT=MSGBUF(2)
        N=INUM(1)+2
        IF(N.LE.NMAX)GO TO 320
310     CONTINUE
        N=N-2
        TYPE "MESSAGE #", N, " DOES NOT EXIST"
        GO TO 900
320     CALL READR(6,N,MSGBUF(1),1,IER)
        IF(MSGBUF(1).EQ.-1)GO TO 310
        IF (IC.NE.'D ') GO TO 400
C
```

```
C       'D' COMMAND
C
        IF(INUM(1).NE.0)GO TO 322
        TYPE "YOU CAN'T DELETE 'ENQ'."
        GO TO 900
322     MSGBUF(1)=-1
        CALL WRITR(6,N,MSGBUF(1),1,IER)
        IF(N.NE.NMAX)GO TO 340
330     NMAX=NMAX-1
        CALL READR(6,NMAX,MSGBUF(1),1,IER)
        IF(MSGBUF(1).EQ.-1)GO TO 330
340     MSGBUF(1)=NMAX
        IF(N.LT.NEXT)NEXT=N
        MSGBUF(2)=NEXT
        CALL WRITR(6,1,MSGBUF(1),1,IER)
        GO TO 900
C
C       'P' COMMAND
C
400     IF(INUM(1).NE.0)GO TO 402
        TYPE "MESSAGE #0:","<15>","'ENQ'"
        GO TO 900
402     WRITE(10,405)INUM(1),(MSGBUF(J),J=3,13),(MSGBUF(J),J=15,25)
405     FORMAT(' ','MESSAGE #',I2,':', 2(/1X,11A2))
C
900     CONTINUE
        CALL CLOSE (6, IER)
        GO TO 1000
C
950     CONTINUE
        TYPE "COMMAND NOT AUTHORIZED!"
C
1000    CONTINUE
        RETURN
        END
```

```
C
        OVERLAY OT14C
        SUBROUTINE T14C (ICODE,INUM,ICHAR,NVAR,ICOUNT,ICHCNT)
C
C
        COMMON/MO/MODEMT(299),MODEM(148),MODEM1(73),NUMMDM
        COMMON/SGN1/XMTBUF(45),RCVBUF(45),SGNADR(2)
        COMMON/SGN2/NWORDS,BUFSIZ,NMSGTX,NMSGRX,MLTSGN(2)
        COMMON/SGN3/SGNSTAT(2),ALMFLG,KCNTD,P4FLG,AMODE
        COMMON/BLOK1/FT14D
C
        INTEGER ICODE(NVAR),INUM(0:ICOUNT),ICHAR(ICHCNT)
        INTEGER SGNSTAT,ALMFLG,KCNTD,P4FLG,AMODE
        INTEGER XMTBUF,RCVBUF,SGNADR,BUFSIZ,MLTSGN,MSGBUF(45),HMS,MDY
        INTEGER FT14D
C
C
C
C
        IF(INUM(1).LT.1 .OR. INUM(1).GT.2)GO TO 2
        IF(NVAR.EQ.2)GO TO 200
C
C
        'S' COMMAND: FORMAT S N M I
C
        IF(ICHCNT.NE.4)GO TO 1
        IF(ICODE(NVAR-1).NE.2)GO TO 1
        IF(ICHAR(3).NE.'M ')GO TO 1
        IF(ICOUNT.LT.2 .OR. ICOUNT.GT.3)GO TO 1
C
        CALL OPEN(6,"MSGFILE",1,IER,2*45)
        CALL READR(6,1,MSGBUF(1),1,IER)
        N=INUM(ICOUNT)+2
        IF(N.LE.MSGBUF(1))GO TO 110
        CALL CLOSE(6,IER)
2       TYPE "DATA ERROR."
        GO TO 1000
1       TYPE "COMMAND NOT AUTHORIZED!"
        GO TO 1000
C
110     CALL READR(6,N,MSGBUF(1),1,IER)
        CALL CLOSE(6,IER)
        IF(MSGBUF(1).NE.-1)GO TO 120
        TYPE "MESSAGE #", INUM(ICOUNT), " DOES NOT EXIST"
        GO TO 1000
C
120     DO 125 I=1,45
125     XMTBUF(I)=MSGBUF(I)
C
        FT14D=1
        GO TO 1000
C
C
        'S' COMMAND: FORMAT S N
C
200     CONTINUE
        IF(ICOUNT.NE.1)GO TO 1
        CALL OPEN(6,"XMTTAB",1,IER,2*45)
        N=NMSGTX
208     CONTINUE
        IF(N.LT.1) GO TO 212
        CALL READR(6,N,MSGBUF(1),1,IER)
        IF(MSGBUF(7).EQ.SGNADR(INUM(1))) GO TO 220
        N=N-1
        GO TO 208
C
212     TYPE "NO MESSAGES TO SIGN"
        GO TO 900
C
220     CONTINUE
        IF (MSGBUF(8).EQ.1280)
     *    TYPE "'ENQ'"
        IF (MSGBUF(8).NE.1280)
     *    WRITE BINARY (10) (MSGBUF(I),I=9,31),MSGBUF(20)
C
900     CONTINUE
        CALL CLOSE(6,IER)
        GO TO 1000
C
1000    CONTINUE
        RETURN
        END
```

```
C
          OVERLAY OT14D
          SUBROUTINE T14D (INUM, ICOUNT)
C
C
          COMMON/TSKSYN/TSK0,TSK1,TSK2,TSK3
          COMMON/SGN1/XMTBUF(45),RCVBUF(45),SGNADR(2)
          COMMON/SGN2/NWORDS,BUFSIZ,NMSGTX,NMSGRX,MTLSGN(2)
          COMMON/SGN3/SGNSTAT(2),ALMFLG,KCNTD,P4FLG,AMODE
          COMMON/BLOK1/FT14D
          COMMON/WKDAY/HMS(3), MDY(3)
C
          INTEGER TSK0,TSK1,TSK2,TSK3
          INTEGER XMTBUF,RCVBUF,SGNADR
          INTEGER NWORDS,BUFSIZ,NMSGTX,NMSGRX,MTLSGN
          INTEGER SGNSTAT,ALMFLG,KCNTD,P4FLG,AMODE
          INTEGER FT14D
          INTEGER HMS ,MDY,INUM(0:ICOUNT)
          INTEGER MSGBUF(45)
C
C
C
          IF (FT14D .NE. 1)  GO TO 900
          FT14D=0
C
          DO 431 I=1,39
431       MSGBUF(I+6)=XMTBUF(I)
          MSGBUF(1)=MDY(3)
          MSGBUF(2)=MDY(1)
          MSGBUF(3)=MDY(2)
C
          CALL TIME(HMS(1),IER)
          DO 432 I=1,3
432       MSGBUF(I+3)=HMS(1)
C
          CALL OPEN(6,"XMTTAB",3,IER,2*45)
          IEND=ICOUNT-1
          DO 436 I=1,IEND
          MTLSGN(I)=INUM(I)
          MSGBUF(7)=SGNADR(INUM(I))
          NMSGTX=NMSGTX+1
          CALL WRITR(6,NMSGTX,MSGBUF(1),1,IER)
436       CONTINUE
          CALL CLOSE(6,IER)
C
          IF(INUM(ICOUNT).EQ.0)MSGBUF(8)=1280
          IF (MSGBUF(8).EQ.1280)
     *      TYPE "'ENQ'"
          IF (MSGBUF(8).NE.1280)
     *      WRITE BINARY (10) (MSGBUF(I),I=9,31),MSGBUF(20)
C
          P4FLG=1
          CALL REC (TSK0, MOO)
C
          IF(AMODE.EQ.0)GO TO 90 ;STAND ALONE MODE
          AMODE=0 ;YES
          KCNTD=0
          P4FLG=0
          TYPE 'BDCSP IN SIGN STAND-ALONE MODE'
          GO TO 900
C
90        CONTINUE
          DO 120 I=1,BUFSIZ
          IF(XMTBUF(I).EQ.RCVBUF(I))GO TO 120 ;XMT AND RCV MESSAGES SAME
          IF(XMTBUF(I).EQ.0)GO TO 121
          IF(I.EQ.1)GO TO 122
          IF(I.EQ.2)GO TO 123
          GO TO 140
122       TYPE 'CMS MODEM ADDRESS RECEIVED =', RCVBUF(1)
          GO TO 150
123       IF(RCVBUF(2).EQ.112400K)GO TO 124 ;BREAK SIGNAL ?
          TYPE 'ERROR IN RETURN MESSAGE-WORD 2' ;NO,ERR IN RETURN MESS
          GO TO 150
124       IF(XMTBUF(2).EQ.002400K)GO TO 130 ;XMT MESSAGE WAS ENQ,OK
          TYPE 'BREAK SIGNAL IN RETURN MESSAGE'
          GO TO 150
121       TYPE 'ECHO-BACK MESSAGE DOES NOT TERMINATE WITH 0'
          GO TO 150
120       CONTINUE
C
130       KCNTD=0
          SGNSTAT(INUM(1))=0
          GO TO 900
C
140       WRITE(10,145) (RCVBUF(I),I=3,13),(RCVBUF(I),I=15,25)
```

```
145     FORMAT(' ','ERROR IN RETURN MESSAGE:',(/' ',11A2))
150     KCNTD=KCNTD+1
        IF(KCNTD.LT.2)GO TO 900 ;TWO ERRORS IN A ROW ?
        KCNTD=0 ;YES,RESET ERR COUNT
        SGNSTAT(INUM(1))=1 ;ERR FLAG SET
        ALMFLG=1 ;FLAG SET TO WRITE TO 'ALMREC' IN ALM50S
        GO TO 900
C
900     CONTINUE
        FT14D=0
        RETURN
        END
```

```
C
        OVERLAY OT15
        SUBROUTINE T15 (ICHAR,ICHCNT,NVAR)
C
        COMMON/GRAPH/MAPNUM,LMAP
        COMMON/OCCRM/OCC,RMETER
C
        INTEGER ICHAR(ICHCNT)
        INTEGER MAPNUM,LMAP
        LOGICAL OCC,RMETER(10)
C
C
C
        IC=ICHAR(1)
        IVAL=1
        IF(IC.EQ.'O ')IVAL=-1     !TRUE
        IF(IC.EQ.'V ')IVAL=0      !FALSE
        IF(IVAL.EQ.1)GO TO 40
        OCC=IVAL
        GO TO 100
C
40      IVAL=-1
        IF(IC.EQ.'N ')IVAL=0
        IF(IC.EQ.'O ')IVAL=1
        IF(IC.EQ.'F ')IVAL=2
        IF(IC.EQ.'W ')IVAL=3
        IF(IC.EQ.'S ')IVAL=4
        IF(IC.EQ.'M ')IVAL=5
        IF(IC.EQ.'H ')IVAL=6
        IF(IC.EQ.'C ')IVAL=7
        IF(IVAL.EQ.-1)GO TO 80
        MAPNUM=IVAL
        GOTO 100
C
80      TYPE "COMMAND NOT AUTHORIZED"
        GO TO 100
C
100     RETURN
        END
```

```
      OVERLAY OT16A
      SUBROUTINE T16A (INUM,ICHAR,ICOUNT,ICHCNT,FLAG)
      COMMON/WPV/WEATHER(36)
      COMMON/WKDAY/HMS(3),MOY(3)
      COMMON/NREC/KL309,NWREC,KINC,KSM,NALREC,KDISP
      COMMON/INCA/INCTV(84),INCREC(21),INCFLAG(21),INCSTAT(21)
C
      INTEGER INUM(0:ICOUNT),ICHAR(ICHCNT),FLAG,RVRSE,INCBUF(4)
      INTEGER HMS,MOY,WEATHER
C
C
C
      FLAG=4
      IF(ICHCNT.EQ.2)GOTO 10
1     TYPE "COMMAND NOT AUTHORIZED!"
      GOTO 1000
2     TYPE "DATA ERROR."
      GOTO 1000
10    IF(ICOUNT.LT.2)GOTO 1
      IF(INUM(1).LT.1)GOTO 2
      IF(INUM(2).GE.INUM(1))GOTO 100
      IF(ICHAR(1).NE.'I ')GOTO 2
C
C     'I' COMMAND
C
      IF(ICOUNT.NE.2)GOTO 1
      IF(INUM(2).NE.0)GOTO 2
      IF(INUM(1).GT.22)GOTO 2
      FLAG=1
      GOTO 1000
100   IF(ICHAR(1).NE.'I ')GOTO 200
      IF(INUM(2).GT.22)GOTO 2
      IF(ICOUNT.NE.6)GOTO 110
      IF(INUM(2).EQ.22)GOTO 2
      RVRSE=0
      IF(INUM(1).GT.3)GOTO 103
101   DO 102 I=1,4
      INCBUF(I)=INCTV(I+4)
      INCTV(I+4)=INCTV(I+8)
102   INCTV(I+8)=INCBUF(I)
      IF(RVRSE.EQ.1)GOTO 107
      RVRSE=1
C
C     'I' THRESHOLD MODE, IE.. I M1 M2 N1 N2 N3 N4
C
103   N1=INUM(1)
      N2=INUM(2)
      DO 105 I=N1,N2
      J=4*I-4
      DO 105 K=1,4
105   INCTV(K+J)=INUM(K+2)
      IF(RVRSE.EQ.1)GOTO 101
107   WRITE(10,108)N1,(INUM(I),I=3,6)
108   FORMAT(/1X,"STATION ",I2,' THRESHOLD: ',4(I3,1X))
      IF(N1.NE.N2)WRITE(10,109)N2
109   FORMAT(/1X,'TO STATION ',I2)
      GOTO 1000
C
110   IF(ICOUNT.NE.2)GOTO 2
      IF(INUM(1).LT.INUM(2))GOTO 120
      FLAG=2
      GOTO 1000
120   IF(KINC.GT.1)GOTO 122
      TYPE "NO INCIDENTS"
      GOTO 1000
122   FLAG=3
C
C     HEADING FOR 'I' DISPLAY MODE, IE.. I M1 M2
C
      WRITE(10,125)MOY(3),MOY(1),MOY(2),(WEATHER(I),I=8,16)
125   FORMAT(/1X,'DATE:  19',I2,2('-',I2),' WEATHER: ',9A2,//1X,
     +'QEW FREEWAY INCIDENT SUMMARY',//1X,
     +'STATION  LANE  BEGIN      END      MAX.MAINLINE Q  DN/VOL  VERIFIED')
      GOTO 1000
200   IF(ICOUNT.NE.2)GOTO 1
      IF(ICHAR(1).NE.'D ')GOTO 300
C
C     FLAG=5 -> 'D' COMMAND
C
      IF(INUM(2).LE.148)GOTO 210
      IF(INUM(1).LT.501)GOTO 2
      IF(INUM(2).GT.532)GOTO 2
210   FLAG=5
      GOTO 1000
C
```

```
C       FLAG=6 -> 'S' COMMAND
C
300     IF(INUM(2).GT.22)GOTO 2
        IF(ICHAR(1).NE.'S ')GOTO 400
        FLAG=6
        GOTO 1000
C
C       FLAG=7 -> 'V' COMMAND
C
400     IF(ICHAR(1).NE.'V ')GOTO 1
        FLAG=7
C
C
1000    RETURN
        END
```

```
C
          OVERLAY OT168
          SUBROUTINE T168 (INUM,ICOUNT,FLAG)
C
C
          COMMON/WKDAY/HMS(3),MDY(3)
          COMMON/NREC/KL30S,NWREC,KINC,K5M,NALREC,KDISP
C
          INTEGER INUM(0:ICOUNT),FLAG
          INTEGER HMS,MDY
          INTEGER INCBUF(25)
C
C         'I' VERIFY MODE, IE., I M M
C
          N=KINC
          CALL OPEN(6,"INCLOG",2,IER,50)
          IF(INUM(2).EQ.0)GOTO 621
610       N=N-1
          IF(N.GT.0)GOTO 620
          TYPE "NO INCIDENT"
          GOTO 1000
620       CALL READR(6,N,INCBUF(1),1,IER)
          IF(INCBUF(4).NE.INUM(2))GOTO 610
621       TYPE " "
          TYPE "STATION LANE BEGIN    END"
          WRITE (10, 624)
624       FORMAT (" ", "   --    --  -- -- -- -- -- --")
          IF(INUM(2).EQ.0)GOTO 635
C
C         'I' ADD MODE, IE., I M 0
C
          IF(INCBUF(9).GT.INCBUF(6))GOTO 630
          WRITE(10,625)(INCBUF(I),I=4,8)
625       FORMAT(/1X,3X,I2,4X,I2,2X,I2,2(':',I2),1X,'-')
          GOTO 634
630       WRITE(10,632)(INCBUF(I),I=4,11)
632       FORMAT(/1X,3X,I2,4X,I2,2X,I2,2(':',I2),1X,I2,2(':',I2))
634       WRITE(10,99)
99        FORMAT(/1X,'CORRECT INCIDENT?: ',Z)
          READ(11,100)IN
100       FORMAT(A1)
          IF(IN.EQ.'N ')GOTO 610
          WRITE (10, 624)
635       READ(11,640)(INCBUF(I),I=18,25)
640       FORMAT(3X,A2,4X,A2,1X,6(1X,A2))
          IF(INUM(2).EQ.0)GOTO 643
          IF(INCBUF(19).EQ.'0 ')GOTO 690
          IF(INCBUF(19).EQ.'- ')GOTO 695
C
643       DO 665 I=18,25
          IF(I.NE.23)GOTO 650
          IF(INCBUF(I).NE.'- ')GOTO 651
          INCBUF(I)=20060K
650       IF(I.EQ.19)GOTO 665
651       ILEFT=ISHFT(INCBUF(I),-8)-48
          IF(ILEFT.EQ.-16)ILEFT=0
          IF(ILEFT.LT.0)GOTO 655
          IF(ILEFT.LT.10)GOTO 660
655       TYPE "ILLEGAL DATA"
          GOTO 621
660       IRIGHT=INCBUF(I).AND.377K-48
          IF(IRIGHT.EQ.-16)IRIGHT=0
          IF(IRIGHT.GT.9)GOTO 655
          IF(IRIGHT.LT.0)GOTO 655
          INCBUF(I)=10*ILEFT+IRIGHT
665       CONTINUE
C
          IF(INCBUF(23).EQ.0)GOTO 670
          IEND=60*INCBUF(23)+INCBUF(24)
          ISTART=INCBUF(20)*60+INCBUF(21)
          IF(ISTART.GE.IEND)GOTO 655
          IF(INCBUF(23).GT.23)GOTO 655
          IF(INCBUF(24).GT.59)GOTO 655
          IF(INCBUF(25).GT.59)GOTO 655
670       IF(INCBUF(18).GT.21)GOTO 655
          IF(INCBUF(20).GT.23)GOTO 655
          IF(INCBUF(21).GT.59)GOTO 655
          IF(INCBUF(22).GT.59)GOTO 655
          INCBUF(17)=1  ;TRUE
          IF(INUM(2).NE.0)GOTO 900
C
C         'I' ADD MODE, IE., I M 0
C
          KINC=N+1
          INCBUF(1)=MDY(3)
```

```
        INCBUF(2)=MDY(1)
        INCBUF(3)=MDY(2)
        DO 680 I=4,16
680     INCBUF(I)=0
        GOTO 900
690     INCBUF(17)=-1  ;FALSE
        GOTO 900
695     INCBUF(17)=0  ;UNVERIFIED
C
900     CALL WRITR(6,N,INCBUF(1),1,IER)
C
1000    CALL CLOSE(6,IER)
        RETURN
        END
```

```
C
      OVERLAY OT16C
      SUBROUTINE T16C (INUM,ICOUNT,FLAG)
C
      COMMON/WKDAY/HMS(3),MDY(3)
      COMMON/NREC/KL30S,NWREC,KINC,K5M,NALREC,KDISP
C
      INTEGER INUM(0:ICOUNT),FLAG,INCBUF(448),STN
      INTEGER HMS,MDY
C
C
C
      IF(FLAG.NE.3)GOTO 300
C
C     FLAG=3 -> 'I' DISPLAY MODE, IE.. I N1 N2
C
      IND=0
      N1=INUM(1)
      N2=INUM(2)
      CALL OPEN(6,"INCLOG",1,IER,50)
      DO 250 STN=N1,N2
      N=0
207   N=N+1
      IF(N.GE.KINC)GOTO 250
      CALL READR(6,N,INCBUF(1),1,IER)
      IF(INCBUF(4).NE.STN)GOTO 207
      IND=1
      ISTART=INCBUF(6)*60+INCBUF(7)
      IEND=INCBUF(9)*60+INCBUF(10)
      IF(IEND.GT.ISTART)GOTO 208
      WRITE(10,215)(INCBUF(I),I=4,8),INCBUF(13),INCBUF(14)
215   FORMAT(/1X,2X,I2,6X,I2,2X,I2,2(':',I2),3X,'-',10X,I3,9X,I4,6X,Z)
      GOTO 238
208   WRITE(10,235)(INCBUF(I),I=4,11),INCBUF(13),INCBUF(14)
235   FORMAT(/1X,2X,I2,6X,I2,2X,I2,2(':',I2),1X,I2,2(':',I2),5X,I3,9X,I4,6X,
238   IF(INCBUF(17).NE.1)GOTO 240
      TYPE "YES"
      GOTO 207
240   TYPE "NO"
      GOTO 207
250   CONTINUE
      CALL CLOSE(6,IER)
      IF(IND.EQ.0)WRITE(10,255)INUM(1),INUM(2)
255   FORMAT(/1X,'NO INCIDENTS FROM STATION ',I2,' TO STATTON ',I2)
      GOTO 1000
C
C     FLAG=7 -> 'V' COMMAND
C
300   N=K5M-7
      IF(N.GT.0)GOTO 302
      TYPE "NO DATA AVAILABLE"
      GOTO 1000
302   N1=INUM(1)
      N2=INUM(2)
      CALL OPEN(6,"DATA5M",1,IER,128)
      CALL READR(6,N,INCBUF(1),7,IER)
      CALL CLOSE(6,IER)
      WRITE(10,305)MDY(3),MDY(1),MDY(2),(INCBUF(I),I=1,3)
305   FORMAT(/1X,'19',I2,2('-',I2),3X,I2,2(':',I2),//1X,
     +'5-MINUTE TRUCK AND CAR COUNT',//1X,
     +8X,'STATION   TRUCK    CAR   SUM   TRUCK %' /).
C
      DO 350 STN=N1,N2
      NCAR=0
      NTRUCK=0
      NCON=163-3*STN
      IF(STN.GE.6)NCON=NCON-1
      NT=NCON+268
      MALF1=0
      MALF2=0
      IEND=2
      IF(STN.EQ.6)IEND=3
C
      DO 310 I=0,IEND
      IND2=0
      IND=0
      IF(INCBUF(NCON+I).GE.0)GOTO 306
      MALF1=MALF1+1
      IND=1
306   IF(INCBUF(NT+I).GE.0)GOTO 309
      MALF2=MALF2+1
      IND2=1
309   IF(IND.EQ.0)NCAR=NCAR+INCBUF(NCON+I)
310   IF(IND2.EQ.0)NTRUCK=INCBUF(NT+I)+NTRUCK
C
```

```
          LANES=IEND+1
          IF(MALF1.NE.LANES.OR.MALF2.NE.LANES)GOTO 320
          NCAR=-1
          NTRUCK=-1
          ISUM=-1
          IPCNTT=-1
          GOTO 345
320       IF(MALF1.NE.LANES)GOTU 330
          NCAR=-1
          IF(NTRUCK.EQ.0)GOTO 325
          ISUM=NTRUCK
          IPCNTT=100
          GOTO 345
325       ISUM=0
          IPCNTT=0
          GOTU 345
330       IF(MALF2.NE.LANES)GOTO 340
          NTRUCK=-1
          IPCNTT=-1
          ISUM=NCAR
          GOTO 345
340       IPCNTT=0
          ISUM=NTRUCK+NCAR
          IF(ISUM.EQ.0)GOTO 345
          IPCNTT=(NTRUCK*100)/ISUM
345       WRITE(10,346)STN,NTRUCK,NCAR,ISUM,IPCNTT
346       FORMAT(1X,10X,I2,7X,I3,5X,I3,3X,I3,5X,I3)
350       CONTINUE
C
C
1000      RETURN
          END
```

```
C
      OVERLAY OT16D
      SUBROUTINE T16D (INUM,ICOUNT,FLAG)
C
      COMMON/GEOM/STOT,DTOT,NRAMPS,NSTNS,CAP(22)
      COMMON/DINDX/XREFTB(180),XREF(113)
      COMMON/NREC/KL30S,NWREC,KINC,KSM,NALREC,KDISP
      COMMON/D30/DATA30(718)
      COMMON/WKDAY/HMS(3),MDY(3)
C
      INTEGER INUM(0:ICOUNT),FLAG,DATA30,ISMBUF(448),HMS,MDY
      INTEGER XREFTB,XREF,STOT,DTOT,CAP
C
C
C
      N1=INUM(1)
      N2=INUM(2)
      IF(FLAG.EQ.6)GOTO 200
C
C     FLAG=5 -> 'D' COMMAND
C
      N=KSM-7
      IF(N.GT.0)GOTO 100
10    TYPE "NO DATA AVAILABLE"
      GOTO 1000
100   CALL OPEN(6,"DATASM",1,IER,128)
      CALL READR(6,N,ISMBUF(1),7,IER)
      CALL CLOSE(6,IER)
      WRITE(10,105)MDY(3),MDY(1),MDY(2),(ISMBUF(I),I=1,3)
105   FORMAT(/1X,'19',I2,2('-',I2),3X,I2,2(':',I2),//1X,
     +'5-MINUTE DETECTOR DATA',//1X,'DETECTOR',10X,'VOLUME',10X,
     +'OCCUPANCY %' /)
      NWSTRT=1
      ISTART=1
C
      DO 150 I=N1,N2
C
C
      DO 140 J=ISTART,180
      IDET=MOD(XREFTB(J),1000)
      IF(IDET.GE.I)GOTO 120
110   NWSTRT=J+1
      GOTO 140
120   IF(IDET.GT.N2)GOTO 110
      DO 122 IPOS=NWSTRT,180
      IDET=MOD(XREFTB(IPOS),1000)
      IF(IDET.EQ.I)GOTO 145
122   CONTINUE
140   CONTINUE
C
145   ISTART=NWSTRT
      IF(IPOS.GT.STOT)GOTO 155
      NVOL=ISMBUF(IPOS+3)
      NOCC=ISMBUF(IPOS+STOT+3)
      GOTO 160
155   NVOL=ISMBUF(IPOS+STOT+3)
      NOCC=ISMBUF(STOT+2*DTOT+IPOS+3)
160   IF(NOCC.LT.1)GOTO 170
      NOCC=(NOCC+35)/75
170   WRITE(10,175)I,NVOL,NOCC
175   FORMAT(1X,3X,I3,13X,I3,15X,I3)
150   CONTINUE
      GOTO 1000
C
C     FLAG=6 -> 'S' COMMAND
C
200   N=KL30S-12
      IF(N.LT.0)GOTO 10
      CALL OPEN(6,"DATA30",1,IER,128)
      CALL READR(6,N,DATA30,12,IER)
      CALL CLOSE(6,IER)
      WRITE(10,215)MDY(3),MDY(1),MDY(2),(DATA30(I),I=1,3)
215   FORMAT(/1X,'19',I2,2('-',I2),1X,I2,2(':',I2),//1X,
     +'30-SECOND MAINLINE SPEED DATA IN KM/H',//1X,
     +8X,'STATION  DL   CL        PL   AVE' /)
C
      DO 230 I=N1,N2
      MALF=0
      IEND=2
      IF(I.EQ.6)IEND=3
      NSPD=475-3*I
      IF(I.LT.6)NSPD=NSPD+1
      NAVE=0
C
      DO 220 N=0,IEND
```

```
          IF(DATA30(NSPD+N).GE.0)GOTO 218
          ISMBUF(N+1)=-1
          MALF=MALF+1
          GOTO 220
218       ISMBUF(N+1)=DATA30(NSPD+N)*36/10
          NAVE=NAVE+ISMBUF(N+1)
220       CONTINUE
C
          IF(MALF.NE.IEND+1)GOTO 224
          NAVE=-1
          GOTO 225
224       NAVE=NAVE/(IEND+1-MALF)
225       IF(I.NE.6)GOTO 222
          WRITE(10,226)I,(ISMBUF(K),K=1,4),NAVE
226       FORMAT(11X,I2,4X,I3,2X,I3,1X,I3,2X,I3,2X,I3)
          GOTO 230
222       WRITE(10,227)I,(ISMBUF(K),K=1,3),NAVE
227       FORMAT(11X,I2,4X,I3,2X,I3,6X,I3,2X,I3,3X,I3)
230       CONTINUE
C
C
1000      RETURN
          END
```

```
C
        OVERLAY OT17A
        SUBROUTINE T17A (ICODE.INUM.ICHAR.NVAR.ICOUNT.ICHCNT.IFLAG)
C
        COMMON/SGN3/SGNSTAT(2).ALMFLG.KCNTD.P4FLG.AMODE
        COMMON/CTRL3/CNTADR(10).CSTAT(10).LTSTAT(10)
        COMMON/ALARM/NOBEEP.ALMBEEP
        COMMON/INCR/OCCOBI(21).OCCUBI(21).INCNT(21).INCONT.INCEX
        COMMON/MO/MODEMT(299).MODEM(148).MODEM1(73).NUMMOM
C
        INTEGER ICODE(NVAR).CHECK.HOLD(2).INUM(0:ICOUNT).ICHAR(ICHCNT)
        INTEGER SGNSTAT.ALMFLG.P4FLG.AMODE.ALMBEEP
        INTEGER OCCOBI.OCCUBI.CNTADR.CSTAT.LTSTAT
C
C
C
        IFLAG=7
        IF(NVAR.NE.1)GOTO 300
        IF(ICHAR(1).NE.'P ')GOTO 10
        IF(ICHAR(2).NE.'  ')GOTO 1
        IFLAG=6
        GOTO 1000
10      IF(ICHCNT.EQ.3)GOTO 100
1       TYPE "COMMAND NOT AUTHORIZED!"
        GOTO 1000
2       TYPE "DATA ERROR."
        GOTO 1000
100     IF(ICHAR(1).NE.'B ')GOTO 200
        IF(ICHAR(2).NE.'A ')GOTO 120
        NOBEEP=0
        GOTO 1000
120     IF(ICHAR(2).NE.'N ')GOTO 140
        INCONT=0
        ALMBEEP=0
        GOTO 1000
140     IF(ICHAR(2).NE.'D ')GOTO 1
        NOBEEP=1
        GOTO 1000
200     IF(ICHAR(1).NE.'S ')GOTO 1
        IF(ICHAR(2).NE.'E ')GOTO 220
        SGNSTAT(1)=0
        SGNSTAT(2)=0
        GOTO 1000
220     IF(ICHAR(2).NE.'D ')GOTO 1
        SGNSTAT(1)=1
        SGNSTAT(2)=1
        GOTO 1000
300     IF(NVAR.NE.2)GOTO 400
        IF(ICHAR(1).NE.'P ')GOTO 1
        IF(ICHAR(2).NE.'  ')GOTO 1
        IF(ICODE(2).NE.1)GOTO 1
        IF(INUM(1).LT.1)GOTO 2
        IF(INUM(1).GT.5)GOTO 2
        IFLAG=INUM(1)
        GOTO 1000
400     IF(ICHCNT.NE.2)GOTO 1
        IF(ICOUNT.NE.2)GOTO 1
        IF(INUM(1).GT.INUM(2))GOTO 2
        IF(ICHAR(1).EQ.'M ')GOTO 700
        IF(INUM(1).LT.1)GOTO 2
        IF(ICHAR(1).EQ.'K ')GOTO 600
        IF(ICHAR(1).EQ.'D ')GOTO 600
        N1=INUM(1)
        N2=INUM(2)
        IF(ICHAR(1).EQ.'C ')GOTO 410
        IF(ICHAR(1).EQ.'L ')GOTO 410
        GOTO 1
410     IF(INUM(2).GT.10)GOTO 2
        DO 450 I=N1.N2
        IF(ICHAR(1).EQ.'C ')GOTO 420
        LTSTAT(I)=0
        GOTO 450
420     CSTAT(I)=0
450     CONTINUE
        GOTO 1000
600     IF(INUM(2).LE.148)GOTO 650
        IF(INUM(1).LT.501)GOTO 2
        IF(INUM(2).GT.532)GOTO 2
650     IFLAG=8
        IF(ICHAR(1).EQ.'K ')IFLAG=9
        GOTO 1000
700     IF(INUM(2).GT.223)GOTO 2
        DO 740 I=1.2
        HOLD(I)=0
        DO 730 J=1.3
```

```
          IDIV=10**(3-J)
          CHECK=MOD(INUM(I),10*IDIV)/IDIV
          IF(CHECK.GT.7)GOTO 2
730       HOLD(I)=CHECK*8**(3-J)+HOLD(I)
740       HOLD(I)=HOLD(I)+1
          N1=HOLD(1)
          N2=HOLD(2)
          DO 750 I=N1,N2
750       MODEM(I)=0
C
1000      RETURN
          END
```

```
C
        OVERLAY OT178
        SUBROUTINE T178 (INUM,ICOUNT,FLAG)
C
        COMMON/SGN3/SGNSTAT(2),ALMFLG,KCNTD,P4FLG,AMODE
        COMMON/DINDX/XREFTB(180),XREF(113)
        COMMON/CTRL3/CNTADR(10),CSTAT(10),LTSTAT(10)
        COMMON/MU/MODEMT(299),MODEM(148),MODEM1(73),NUMMDM
C
        INTEGER INUM(0:ICOUNT)
        INTEGER SGNSTAT,ALMFLG,P4FLG,AMODE,XREFTB,XREF,FLAG
        INTEGER CNTADR,CSTAT,LTSTAT,START,DUMMY(180)
C
C
C
        IF(FLAG.GT.7)GOTO 1000
        START=FLAG
        IF(FLAG.NE.6)GOTO 10
        START=1
        FLAG=5
10      DO 900 I=START,FLAG
        TYPE " "
        J=0
        GOTO(100,200,300,400,500),I
100     TYPE "LOOP DETECTORS:"
        INUM(1)=1
        INUM(2)=148
        GOTO 1000
110     IF(INUM(1).EQ.501)GOTO 800
        INUM(1)=501
        INUM(2)=532
        GOTO 1000
200     TYPE "RAMP CONTROLLERS:"
        DO 220 K=1,10
        IF(CSTAT(K).EQ.0)GOTO 220
        J=J+1
        DUMMY(J)=K
220     CONTINUE
        GOTO 800
300     TYPE "SIGNAL LIGHTS:"
        DO 330 K=1,10
        IF(LTSTAT(K).EQ.0)GOTO 330
        J=J+1
        DUMMY(J)=K
330     CONTINUE
        GOTO 800
400     TYPE "DATA MODEMS:"
        DO 410 K=1,148
        IF(MODEM(K).EQ.0)GOTO 410
        ISUB=K-1
        J=J+1
        KOCTAL=0
        DO 405 L=0,3
        M=3-L
        IDIV=8**M
        KOCTAL=10**M*(ISUB/IDIV)+KOCTAL
        ISUB=MOD(ISUB,IDIV)
405     CONTINUE
        DUMMY(J)=KOCTAL
410     CONTINUE
        GOTO 800
500     TYPE "CHANGEABLE MESSAGE SIGNS:"
        DO 550 K=1,2
        IF(SGNSTAT(K).EQ.0)GOTO 550
        J=J+1
        DUMMY(J)=K
550     CONTINUE
800     IF(J.NE.0)GOTO 803
        TYPE "NONE"
        GOTO 900
803     CONTINUE
        WRITE(10,805)(DUMMY(K),K=1,J)
805     FORMAT (16(1X,I4))
900     CONTINUE
        GOTO 2000
1000    N1=INUM(1)
        N2=INUM(2)
        ISTART=1
        NWSTRT=1
        DO 1100 IDETECT=N1,N2
        DO 1010 IJ=ISTART,180
        IDET=MOD(XREFTB(IJ),1000)
        IF(IDET.GE.IDETECT)GOTO 1015
1007    NWSTRT=IJ+1
        GOTO 1010
```

```
1015    IF(IDET.GT.N2)GOTO 1007
        DO 1050 IPOS=NWSTRT,180
        IDET=MOD(XREFTB(IPOS),1000)
        IF(IDET.EQ.IDETECT)GOTO 1020
1050    CONTINUE
1010    CONTINUE
1020    ISTART=NWSTRT
        IF(FLAG.GT.6)GOTO 1030
        IF(XREFTB(IPOS).LT.1000)GOTO 1100
        J=J+1
        DUMMY(J)=IDETECT
        GOTO 1100
1030    XREFTB(IPOS)=IDETECT
        IF(FLAG.EQ.9)XREFTB(IPOS)=XREFTB(IPOS)+1000
1100    CONTINUE
        IF(FLAG.LT.6)GOTO 110
C
2000    RETURN
        END
```

```
C
          OVERLAY OT18A
          SUBROUTINE T18A (ICODE.INUM.ICHAR.NVAR.ICOUNT.ICHCNT.FLAG)
C
C
          COMMON/COMM/DETECT(545).NDETRC.NOKEY
          COMMON/NREC/KL30S.NWREC.KINC.K5M.NALREC.KDISP
        . COMMON/WKDAY/HMS(3).MDY(3)
C
          INTEGER ICODE(NVAR).INUM(0:ICOUNT).ICHAR(ICHCNT)
          INTEGER DETECT. NDETRC. NOKEY
          INTEGER HMS.MDY
          INTEGER FLAG. OUTBUF(545)
C
          LOGICAL ITEST
C
C         FLAG=0 : COMMAND COMPLETED
C         FLAG=1 : COMMAND=A
C         FLAG=2 : COMMAND=Y
C         FLAG=3 : COMMAND=S
C         FLAG=4 : COMMAND=DI
C         FLAG=5 : COMMAND=EN
C         FLAG=6 : COMMAND=F
C         FLAG=7 : COMMAND=W
C         FLAG=8 : COMMAND=M
C         FLAG=9 : COMMAND=Z
C
C
C

          FLAG=0
          IF(NVAR.NE.1)GO TO 900
          IF(ICHCNT.LT.3)GO TO 300
          IF(ICHCNT.NE.3)GO TO 1
          IF(ICHAR(1).EQ.'D '.AND.ICHAR(2).EQ.'I ')GO TO 100
          IF(ICHAR(1).EQ.'E '.AND.ICHAR(2).EQ.'N ')GO TO 100
1         TYPE "COMMAND NOT AUTHORIZED!"
          GO TO 2000
2         TYPE "DATA ERROR."
          GO TO 2000
C
C
100       FLAG=ISHFT(ICHAR(1),-8).AND.7
          GO TO 2000
C
C
300       IF(ICHAR(1).EQ.'D ')GO TO 400
          IF(ICHAR(1).EQ.'T ')GO TO 500
          IF(ICHAR(1).EQ.'M ')GO TO 600
          IF(ICHAR(1).EQ.'W ')GO TO 100
          IF(ICHAR(1).EQ.'Y ')GO TO 800
          IF(ICHAR(1).EQ.'F ')GO TO 100
          IF(ICHAR(1).NE.'Z ')GO TO 1
C
C
C         'Z' CUMMAND
C
C
          FLAG=9
          GO TO 2000
C
C
C         'D' COMMAND
C
C
C
400       CONTINUE
C
C         WAIT TILL NEXT MINUTE
C
          CALL TIME (HMS(1), IER)
          HMS(3) = 60 - HMS(3)
          CALL WAIT (HMS(3). 2. IER)
C
C         PRINT DATE AND STARTING TIME
C
          CALL TIME (HMS(1), IER)
          WRITE (12. 410) (MDY(I). I=1.3). (HMS(I). I=1.3)
410       FORMAT ('1'. '1 MIN. OF DETECTOR DATA:', 10X.
     *            'DATE = '. I2. '/'. I2. '/'. I2. 10X.
     *            'STARTING TIME = '. I2. ':'. I2. ':'. I2 /)
C
C         CREATE AND OPEN 'DET60S' FILE
C
          CALL CFILW ('DET60S'. 2. IER)
          CALL OPEN (6. 'DET60S'. 2. IER. 2*545)
C
```

```
C       WAIT TILL 60 SEC. HAVE ELAPSED IN TASK 'COMCOM'
C
        NOETRC = 1
        CALL REC (NDKEY, MSGDTN)
        NOETRC = 0
C
C       PRINT 'DET60S' RECORDS
C
        REWIND 6
        DO 450 I = 1, 60
            CALL READR (6, I, OUTBUF(1), 1, IER)
            WRITE (12, 470) I, (OUTBUF(J), J=1,545)
470         FORMAT ('0', 'RECORD # ', I4, ' IS' / (1X, 15I8) )
450       CONTINUE
C
C       CLOSE AND DELETE 'DET60S' FILE
C
        CALL CLOSE (6, IER)
        CALL DFILW ('DET60S', IER)
        GO TO 2000
C
C
C       'T' COMMAND
C
C
C
500     CONTINUE
        CALL TIME (HMS(1), IER)
        WRITE (10, 505) MDY(3),MDY(1),MDY(2),
     *    HMS(1),HMS(2),HMS(3)
505     FORMAT (' ',I2,2('/',I2),3X,I2,2(':',I2))
        GO TO 2000
C
C
C       'M' COMMAND
C
C
C
600     CONTINUE
        FLAG=8
        GO TO 2000
C
C
C       'Y' COMMAND
C
C
C
800     CONTINUE
        FLAG=2
        GO TO 2000
C
C
900     IF(ICHCNT.NE.2)GO TO 1
        IF(ICOUNT.NE.3)GO TO 1000
        IF(INUM(1).GT.INUM(2))GO TO 2
        IF(INUM(1).LT.1)GO TO 2
        IF(ICHAR(1).NE.'A ')GO TO 910
        IF(INUM(2).GT.10)GO TO 2
        GO TO 100
910     IF(ICHAR(1).NE.'S ')GO TO 1
        IF(INUM(2).GT.2)GO TO 2
        GO TO 100
C
C
1000    IF(NVAR.NE.2)GO TO 1
        IF(ICOUNT.NE.1)GO TO 1
        IF(ICHAR(1).NE.'P ')GO TO 1
        TYPE "COMMAND NOT YET IMPLEMENTED"
C
C
2000    RETURN
        END
```

```
C
      OVERLAY OT188
      SUBROUTINE T188 (INUM,ICOUNT,FLAG)
C
C
      COMMON/CTRL3/CNTADR(10),CSTAT(10),LTSTAT(10)
      COMMON/CTRL6/COMOOP(8),CNTON(10),NBRAMP
      COMMON/SGN1/XMTBUF(45),RCVBUF(45),SGNADR(2)
      COMMON/MD/MODEMT(299),MODEM(148),MODEM1(73),NUMMDM
      COMMON/RANGE/UPRNGE(113,2),DNRNGE(67,3)
      COMMON/WPV/WEATHER(36)
      COMMON/NREC/KL30S,NWREC,KINC,KSM,NALREC,KDISP
C
      INTEGER INUM(0:ICOUNT),FLAG,WEATHER
      INTEGER COMOOP,CNTON,NBRAMP
      INTEGER CNTADR,CSTAT,LTSTAT
      INTEGER XMTBUF,RCVBUF,SGNADR
      INTEGER UPRNGE,DNRNGE
      INTEGER OUTBUF(545)
C
C
C
C
      GO TO (500,300,600,100,200,1000,400,800,900), FLAG
C
C
C     'DI' COMMAND
C
C
100   CALL ODIS
      TYPE "CTRL A INTERRUPT DISABLED"
      GO TO 1000
C
C
C     'EN' COMMAND
C
C
200   CALL OEBL
      TYPE "CTRL A INTERRUPT ENABLED"
      GO TO 1000
C
C
C     'Y' COMMAND
C
C
300   CONTINUE
      DO 310 I=1,226
310   OUTBUF(I)=UPRNGE(I)
      DO 320 I=1,201
320   OUTBUF(I+226)=DNRNGE(I)
      WRITE (10, 330) (OUTBUF(I), I=1,427)
330   FORMAT (' ','UPRNGE(113,2)',2(/1X,7(/1X,15I5)/1X,8I5)
     *  //1X,'DNRNGE(67,3)',3(/1X,4(/1X,15I5)/1X,7I5))
      GO TO 1000
C
C
C     'W' COMMAND
C
C
400   WRITE(10,405)
      READ(11,406)(WEATHER(I),I=8,16)
      WRITE(10,407)
      READ(11,406)(WEATHER(I),I=18,26)
      WRITE(10,408)
      READ(11,406)(WEATHER(I),I=28,36)
405   FORMAT(' ENTER CONDITIONS:' / '   WEATHER      >',Z)
406   FORMAT(9A2)
407   FORMAT('   PAVEMENT    >',Z)
408   FORMAT('   VISIBILITY  >',Z)
      N=NWREC-1
      CALL OPEN(6,"WEATHER",3,IER,2*36)
      CALL WRITR(6,N,WEATHER(1),1,IER)
      CALL CLOSE(6,IER)
      GO TO 1000
C
C
C     'A' COMMAND
C
C
500   N1=INUM(1)
      N2=INUM(2)
      DO 510 I=N1,N2
510   CNTADR(I)=INUM(3)
      WRITE(10,515)CNTADR
515   FORMAT(' ','CNTADR',10(1X,I6))
```

```
        GO TO 1000 .
C
C
C       'S' COMMAND
C
C
C
600     N1=INUM(1)
        N2=INUM(2)
        DO 610 I=N1.N2
610     SGNADR(I)=INUM(3)
        TYPE "IN SUBR 'T188', SGNADR =",SGNADR
        GO TO 1000
C
C
C       'M' COMMAND
C
C
C
800     CONTINUE
        DO 810 I=4.151
810     OUTBUF(I)=MODEMT(I)
        WRITE (10, 830) (OUTBUF(I), I=4.151)
830     FORMAT (' '.'MODEMT(4:151):' /1X.10(/1X.15I5))
        GO TO 1000
C
C
C       'Z' COMMAND
C
C
C
900     CONTINUE
        DO 930 I=1.8
        DO 910 J=1.16
        K=16-J
        OUTBUF(J)=ITEST(COMDOP(I).K) .AND. 1
910     CONTINUE
        WRITE (10, 920) I, (OUTBUF(L), L=1.16)
920     FORMAT (' '.'COMDOP('.I1.')=    '.16I1)
930     CONTINUE
        GO TO 1000
C
C
1000    RETURN
        END
```

```
C
        OVERLAY OT18C
        SUBROUTINE T18C
C
        COMMON/SCREEN/GCHN,PFILE,RQEW,RWTEMP
        COMMON/NREC/KL30S,NWREC,KINC,K5M,NALREC,KDISP
        COMMON/SGN2/NWORDS,BUFSIZ,NMSGTX,NMSGRX,MLTSGN(2)
        COMMON/RDFIL/RDRCD,RSDVR(21)
C
        INTEGER GCHN,PFILE,RQEW,RWTEMP
        INTEGER KL30S,NWREC,KINC,K5M,NALREC,KDISP
        INTEGER NWORDS,BUFSIZ,NMSGTX,NMSGRX,MLTSGN
        INTEGER RDRCD,RSDVR
C
        INTEGER DMPREC(8)
C
C
        CALL PRI (0)                        !RAISE TO HIGHEST PRIORITY
C
        CALL RUCLK                          !REMOVE USER CLOCK
C
        CALL IBRMV (IER)                    !REMOVE ISI/300 FROM SYSTEM
        IF (IER .NE. 1)
     *    TYPE "IBRMV IER =", IER
C
        CALL CLOSE (GCHN, IER)              !CLOSE GRAPHICS CHANNEL
        IF (IER .NE. 1)
     *    TYPE "GCHN CLOSE IER =", IER
C
        CALL ABORT (10, IER)                !ABORT TASK 'COMCOM'
        IF (IER .NE. 1)
     *    TYPE "COMCOM ABORT IER =", IER
        CALL ABORT (20, IER)                !ABORT TASK 'CORCAS'
        IF (IER .NE. 1)
     *    TYPE "CORCAS ABORT IER =", IER
        CALL ABORT (30, IER)                !ABORT TASK 'TRANSF'
        IF (IER .NE. 1)
     *    TYPE "TRANSF ABORT IER =", IER
        CALL ABORT (40, IER)                !ABORT TASK 'GMAP'
        IF (IER .NE. 1)
     *    TYPE "GMAP ABORT IER =", IER
C
C
        NMSGTX=NMSGTX+1
        RDRCD=RDRCD-1
C
        DMPREC(1)=KL30S
        DMPREC(2)=NWREC
        DMPREC(3)=KINC
        DMPREC(4)=K5M
        DMPREC(5)=NALREC
        DMPREC(6)=KDISP
        DMPREC(7)=NMSGTX
        DMPREC(8)=RDRCD
        CALL OPEN(6,"DMPREC",3,IER,2*8)
        CALL WRITR (6,1,DMPREC(1),1,IER)
        CALL CLOSE(6,IER)
C
        WRITE(10,135)(DMPREC(I),I=1,8)
135     FORMAT(1X,2X,'FILES',5X,'RCDS'/
     +  1X,2X,'-----',5X,'----'/
     +  '    DATA30 : ',I5/
     +  '    WEATHER: ',I5/
     +  '    INCLOG : ',I5/
     +  '    DATASM : ',I5/
     +  '    ALMREC : ',I5/
     +  '    GEWDYN : ',I5/
     +  '    XMTTAB : ',I5/
     +  '    RESDEV : ',I5)
C
        TYPE "* QEW SYSTEM SHUT DOWN *"
C
        RETURN
        END
```

```
C
      OVERLAY OT180
      SUBROUTINE T180
C
      COMMON/SGN2/NWORDS,BUFSIZ,NMSGTX,NMSGRX,MLTSGN(2)
      COMMON/NREC/KL30S,NWREC,KINC,KSM,NALREC,KDISP
      COMMON/WKDAY/HMS(3),MDY(3)
      COMMON/RDFIL/RDRCD,RSDVR(21)
C
      INTEGER NWORDS,BUFSIZ,NMSGTX,NMSGRX,MLTSGN
      INTEGER KL30S,NWREC,KINC,KSM,NALREC,KDISP
      INTEGER HMS,MDY
      INTEGER RDRCD,RSDVR
C
      INTEGER RECFM(11)
C
C
      RECFM(1)=53505K
      RECFM(2)=40524K
      RECFM(3)=44105K
      RECFM(4)=51040K
      RECFM(5)=MDY(3)
      RECFM(6)=MDY(1)
      RECFM(7)=MDY(2)
      RECFM(8)=2*36
      RECFM(9)=1
      RECFM(10)=36
      RECFM(11)=NWREC
      CALL OPEN(6,"WEATHER",3,IER,2*36)
      CALL WRITR(6,0,RECFM(1),1,IER)
      CALL CLOSE(6,IER)
C
C
      RECFM(1)=44516K
      RECFM(2)=41514K
      RECFM(3)=47507K
      RECFM(4)=20040K
      RECFM(8)=2*25
      RECFM(10)=25
      RECFM(11)=KINC
      CALL OPEN(6,"INCLOG",3,IER,2*25)
      CALL WRITR(6,0,RECFM(1),1,IER)
      CALL CLOSE(6,IER)
C
C
      RECFM(1)=40514K
      RECFM(2)=46522K
      RECFM(3)=42503K
      RECFM(8)=2*14
      RECFM(10)=14
      RECFM(11)=NALREC
      CALL OPEN(6,"ALMREC",3,IER,2*14)
      CALL WRITR(6,0,RECFM(1),1,IER)
      CALL CLOSE(6,IER)
C
C
      RECFM(1)=54115K
      RECFM(2)=52124K
      RECFM(3)=40502K
      RECFM(8)=2*51
      RECFM(10)=51
      RECFM(11)=NMSGTX
      CALL OPEN(6,"XMITAB",3,IER,2*51)
      CALL WRITR(6,0,RECFM(1),1,IER)
      CALL CLOSE(6,IER)
C
C
      RECFM(1)=51105K
      RECFM(2)=51504K
      RECFM(3)=42526K
      RECFM(8)=2*26
      RECFM(10)=26
      RECFM(11)=RDRCD
      CALL OPEN(6,"RESDEV",3,IER,2*26)
      CALL WRITR(6,0,RECFM(1),1,IER)
      CALL CLOSE(6,IER)
C
C
      RECFM(1)=42101K
      RECFM(2)=52101K
      RECFM(3)=31460K
      RECFM(8)=2*64
      RECFM(9)=12
      RECFM(10)=718
      RECFM(11)=KL30S
      CALL OPEN(6,"DATA30",3,IER,2*64)
      CALL WRITR(6,0,RECFM(1),1,IER)
      CALL CLOSE(6,IER)
C
C
      RECFM(1)=42101K
      RECFM(2)=52101K
      RECFM(3)=32515K
      RECFM(9)=7
      RECFM(10)=430
      RECFM(11)=KSM
      CALL OPEN(6,"DATA5M",3,IER,2*64)
      CALL WRITR(6,0,RECFM(1),1,IER)
      CALL CLOSE(6,IER)
C
C
      RECFM(1)=50505K
      RECFM(2)=53504K
      RECFM(3)=54516K
      RECFM(9)=8
      RECFM(10)=481
      RECFM(11)=KDISP
      CALL OPEN(6,"QEWDYN",3,IER,2*64)
      CALL WRITR(6,0,RECFM(1),1,IER)
      CALL CLOSE(6,IER)
C
      RETURN
      END
```

```
C
      OVERLAY OUPD30S
      SUBROUTINE UPD30S
C
C DATE: 80-1-18
C   THIS TASK IS EXECUTED ONCE EVERY 30 SECONDS IMMEDIATELY AFTER
C       TASK TRANSF. IT CHECKS DETECTOR FOR MALFUNCTION. IT TAKES ONE
C       OF THE FOLLOWING ACTIONS DEPENDING ON THE DETECTOR STATUS.
C
C   IN PAIRED LOOP DETECTORS:
C   CASE A: IF UPSTREAM DETECTOR NOT O.K. AND DOWNSTREAM DETECTOR NOT O.K.
C           SET CORRESPONDING VOLUME, OCCUPANCY, SPEED AND VEHICLE TYPE
C           TO -1.
C   CASE B: IF UPSTREAM DETECTOR IS O.K. BUT NOT DOWNSTREAM THEN SET
C           CORRESPONDING SPEED, AND VEHICLE TYPE TO -1. BUT USE UPSTREAM
C           VOLUME & OCCUPANCY AS CORRESPONDING DOWNSTREAM VALUES.
C   CASE C: IF UPSTREAM DETECTOR IS NOT O.K. BUT DOWNSTREAM IS O.K. THEN
C           SET CORRESPONDING SPEED AND VEHICLE TYPE TO -1.
C   CASE D: IF UPSTREAM AND DOWNSTREAM DETECTORS ARE O.K. MAKE NO
C           CHANGES
C
C   THIS TASK ALSO CONSOLIDATES LANE INTO STATION DATA. THE STATION
C   DATA IS SET TO -1 IFF ALL THE LANE DATA ARE -1; OTHERWISE, THE
C   REMAINING 'GOOD' LANE DATA ARE USED TO DERIVE STATION DATA.
C
C   CSOCC: LATEST 30 SEC OCC
C   PSOCC: NEXT TO LATEST 30 SEC OCC
C   SOCC1M: LATEST 1 MIN OCC
C   SVOL1M: LATEST 1 MIN VOL
C   CSVOL: LATEST 30 SEC VOL
C   PSVOL: NEXT TO THE LATEST 30 SEC VOL
C   SSPD: LATEST 30 SEC SMOOTHED SPEED
C   LNSTS: NUMBER OF LANES IN A STATION GIVING VOL OCC SSPEED DATA
C
      DIMENSION DATASM(448)
      DIMENSION SDVOL(46),SDOCC(46)
      DIMENSION DNVOL(67),UPVOL(67),DNOCC(67),UPOCC(67),LNSPD(67)
      DIMENSION LVCNT(67)
      DIMENSION CSOCC(22),PSOCC(22),SOCC1M(22),SVOL1M(22),CSVOL(22),
     *PSVOL(22),SSPD(22),LNSTS(22)
C
      COMMON/Q02/QWAIT(10),QLNTH(10)
      COMMON/CTRL1/CONTRL,MAXCYC,METER(10),MODCYC(10)
      COMMON/CTRL2/CYCOVR(10),RAMCYC(10)
      COMMON/WKDAY/HMS(3),MDY(3)
      COMMON/GEOM/STOT,DTOT,NRAMPS,NSTNS,CAP(22)
      COMMON/SECTL/DIST(20)
      COMMON/TTS/TT(20)
      COMMON/D30/DATA30(718)
      COMMON/TCNT/COUNT,KCNTSM,IMINS,KCOUNT
      COMMON/NREC/KL30S,NWREC,KINC,KSM,NALREC,KDISP
C
      INTEGER DATASM
      INTEGER QWAIT,QLNTH
      INTEGER CONTRL,MAXCYC,METER,MODCYC
      INTEGER CYCOVR,RAMCYC
      INTEGER SDVOL,SDOCC
      INTEGER DNVOL,UPVOL,DNOCC,UPOCC,LNSPD,LVCNT
      INTEGER CSOCC,PSOCC,SOCC1M,SVOL1M,CSVOL,PSVOL,SSPD,LNSTS
      INTEGER HMS,MDY
      INTEGER STOT,DTOT,NRAMPS,NSTNS,CAP
      INTEGER DIST
      INTEGER TT
      INTEGER DATA30
      INTEGER COUNT,KCNTSM,IMINS,KCOUNT
      INTEGER KL30S,NWREC,KINC,KSM,NALREC,KDISP
      INTEGER DSTAT,DNSTAT,UPSTAT
      INTEGER NPOS,VOLSUM,OCCSUM,SPDSUM,NSP
      INTEGER I,K,J,I1,I2,IK,NLANE,NSTNM2,ISPD
C
      EQUIVALENCE (SDVOL(1),DATA30(49)),(SDOCC(1),DATA30(95)),
     *(DNVOL(1),DATA30(141)),(UPVOL(1),DATA30(208)),
     *(DNOCC(1),DATA30(275)),(UPOCC(1),DATA30(342)),
     *(LNSPD(1),DATA30(409)),(LVCNT(1),DATA30(476))
      EQUIVALENCE (CSOCC(1),DATA30(543)),(PSOCC(1),DATA30(565)),
     *(SOCC1M(1),DATA30(587)),(SVOL1M(1),DATA30(609)),
     *(CSVOL(1),DATA30(631)),(PSVOL(1),DATA30(653)),
     *(SSPD(1),DATA30(675)),(LNSTS(1),DATA30(697))
C
C
C CONSOLIDATE LANE DATA INTO STATION DATA
C
C
      DO 100 I=1,NSTNS
      J=NSTNS-I+1 ;STN NO
```

```
        PSOCC(J)=CSOCC(J)
        PSVOL(J)=CSVOL(J)
        I1=3*I-2 ;MOST STNS HAVE 3 LANES
        I2=I1+2
        IF(J.LE.6)I2=I2+1 ;STN6 HAS 4 LANES
        IF(J.LT.6)I1=I1+1
        NPOS=0
        VOLSUM=0
        OCCSUM=0
        DO 150 IK=I1.I2
        IF(DNOCC(IK).LT.0)GOTO 150 ;IF OCC IS WRONG,SO IS VOL
        NPOS=NPOS+1
        VOLSUM=VOLSUM+DNVOL(IK) ;ADD LANE VOL
        OCCSUM=OCCSUM+DNOCC(IK) ;ADD LANE OCC
  150   CONTINUE
        IF(NPOS.EQ.0)GOTO 120 ;IF OCC WRONG ,SO ARE VOL,SPD.V. TYPES
        NLANE=3
        CSOCC(J)=OCCSUM*NLANE/NPOS ;LATEST 30 SEC STN OCC
        CSVOL(J)=VOLSUM*NLANE/NPOS ;LATEST 30-SEC STN VOL
        SOCC1M(J)=CSOCC(J)+PSOCC(J) ;LATEST 1-MIN OCC
        SVOL1M(J)=CSVOL(J)+PSVOL(J)
        IF(PSOCC(J).LT.0)SOCC1M(J)=-1 ;IF PAST 30-SEC DATA IS WRONG
        IF(PSVOL(J).LT.0)SVOL1M(J)=-1 ;THEN 1-MIN DATA IS ALSO WRONG
        SPDSUM=0
        NSP=0
        NPOS=0
        DO 160 IK=I1.I2
        IF(LNSPD(IK).LT.0)GOTO 160 ;IF SPD IS WRONG,SO IS V. TYPE
        NPOS=NPOS+1
        IF(LNSPD(IK).GT.0)NSP=NSP+1 ;NO OF POS SPEEDS
        SPDSUM=SPDSUM+LNSPD(IK) ;ADD LANE SPEEDS
  160   CONTINUE
        IF(NPOS.EQ.0)GOTO 140 ;ALL LANE DATA NO GOOD
        SSPD(J)=SPDSUM
        IF(NSP.GT.0)SSPD(J)=SPDSUM/NSP ;AVG STN SPEED
        GOTO 110
  120   CSOCC(J)=-1
        SOCC1M(J)=-1
        SVOL1M(J)=-1
        CSVOL(J)=-1
  140   SSPD(J)=-1
  110   LNSTS(J)=NPOS ;NO OF 'GOOD' LANES AT THIS STN
  100   CONTINUE
C
C
C COMPUTE SECTION TRAVEL TIMES
C
        NSTNM2=NSTNS-2
        DO 500 I=1.NSTNM2
        I1=I ;UPSTR STN
        IF(I.GE.3)I1=I+1
        I2=I1+1 ;DOWNSTR STN
        IF(I.EQ.2)I2=I1+2
        ISPD=(SSPD(I1)+SSPD(I2))/2 ;AVG SECTION SPEED
        TT(I)=DIST(I)
        IF(SSPD(I1).LT.0.AND.SSPD(I2).LT.0)TT(I)=-1
        IF(SSPD(I1).LT.0)ISPD=SSPD(I2)
        IF(SSPD(I2).LT.0)ISPD=SSPD(I1)
        IF(ISPD.GT.0)TT(I)=DIST(I)/ISPD
 500    CONTINUE
C
        DO 600 I=1.3
  600   DATA30(I)=HMS(I)
        DATA30(4)=CONTRL ;CONTROL PERIOD
        DO 602 I=1.NRAMPS
        J=(I-1)*4+9
        DATA30(J)=MODCYC(I)
        DATA30(J+1)=RAMCYC(I)
        DATA30(J+2)=QWAIT(I)
        DATA30(J+3)=QLNTH(I)
 602    CONTINUE
        CALL OPEN(3."DATA30".3.IER.2*64)
        CALL WRITR(3.KL30S.DATA30(1).12.IER)
        CALL CLOSE(3.IER)
        KL30S=KL30S+12
C
C ACCUMULATE 5-MIN DATA
C
        CALL OPEN(3."DATA5M".2.IER.2*64)
        CALL READR(3.K5M.DATA5M.7.IER)
        DO 612 I=1.3
 612    DATA5M(I)=DATA30(I)
        DO 620 I=4.430
        J=I+45
        IF(I.GE.364)J=I+112 ;BYPASS SPD DATA
        IF(COUNT.EQ.1)GOTO 610
        IF(DATA30(J).LT.0.OR.DATA5M(I).LT.0)DATA5M(I)=-1
        IF(DATA5M(I).GE.0)DATA5M(I)=DATA5M(I)+DATA30(J) ;ACC 5-MIN DATA
        GOTO 620
610     DATA5M(I)=DATA30(J) ;FIRST 30-SEC DATA
620     CONTINUE
        CALL WRITR(3,K5M,DATA5M,7,IER)
        CALL CLOSE(3,IER)
        COUNT=COUNT+1
        IF(COUNT.LE.10) GO TO 900
        COUNT=1 ;5-MIN ALREADY
        IMIN5=1 ;5 MINS ALREADY
        K5M=K5M+7 ;REC FOR NEXT 5 MINS
        GO TO 900
C
900     CONTINUE
        RETURN
        END
```

```
C
        COMPILER NOSTACK
        OVERLAY OVTLU
        SUBROUTINE VTLU
        COMMON/HKDAY/HMS(3).MDY(3)
        COMMON/INCA/INCTV(84).INCREC(21).INCFLAG(21).INCSTAT(21)
C
        COMMON/INCD/INCPRG(21).INCOT.INCVT.INCST
        COMMON/RDFIL/RDRCD.RSDVR(21)
C
        INTEGER HMS.MDY.INCREC.INCSTAT
        INTEGER INCPRG.INCOT.INCVT.INCST.RDRCD.RSDVR
        INTEGER LNOCC(66).LNVOL(66).LNSPD(66).STNOCC(22).STNVOL(22).STNSPD(22)
        INTEGER DRIV.CNTR.PASS
        INTEGER OCCVOT(3).VOLVOT(3).SPDVOT(3).OCCMAJ.VOLMAJ.SPDMAJ
        INTEGER INCLAN
        INTEGER INCLOG(25).RESOV(26)
        INTEGER STN.I
        INTEGER DNOCC.DNVOL.DNSPD
        INTEGER OCWT.VLWT.SPWT
C
        DATA OCWT/1/, SPWT/1/, VLWT/1/
C
C UTILIZE INCSTAT ARRAY TO DETERMINE IF/AND WHERE AN INCIDENT OCCURRED
C
        DO 20 STN=1.21
          IF(STN.EQ.3)GOTO 20;                                  STATTON THREE HAS NO DOWNSTREAM STATION
C
C DETERMINE WHETHER OR NOT A NEW INCIDENT HAS BEEN DETECTED
C
            IF(INCSTAT(STN).EQ.INCPRG(STN))GOTO 20;             NO NEW INCIDENT
              INCPRG(STN)=1;                                    NEW INCIDENT
          CALL OPEN(3,'RESDEV',1,IER,2*26)
          CALL READR(3.RSDVR(STN).RESOV(1).1.IER)
          CALL CLOSE(3.IER)
          DO 21 I=1.3
            OCCVOT(I)=RESOV(14+I)
            VOLVOT(I)=RESOV(18+I)
            SPDVOT(I)=RESOV(22+I)
21          CONTINUE
C
C
C IMPLEMENT SECOND LEVEL DECISION ROUTINE - PRIMARY VTLU(VOTE TAKING LOGIC UNIT)
C USE DATA COMPILED BY CLOU'S
C TALLY OCCVOT DATA
C
C
          OCCMAJ=0;                                           IF NOT CHANGED(REMAINS ZERO) A NULL (TIE)VOTE HAS RESULTED
          IF(OCCVOT(1).EQ.OCCVOT(2))OCCMAJ=OCCVOT(1);         IF TWO VOTES ARE
          IF(OCCVOT(1).EQ.OCCVOT(3))OCCMAJ=OCCVOT(1);         THE SAME ,THEN THEY FORM A
          IF(OCCVOT(2).EQ.OCCVOT(3))OCCMAJ=OCCVOT(2);         TWO OUT OF THREE MAJORITY
C
C TEST VOL. RESULTS NEXT
C
          VOLMAJ=0
          IF(VOLVOT(1).EQ.VOLVOT(2))VOLMAJ=VOLVOT(1)
          IF(VOLVOT(1).EQ.VOLVOT(3))VOLMAJ=VOLVOT(1)
          IF(VOLVOT(2).EQ.VOLVOT(3))VOLMAJ=VOLVOT(2)
C
C TEST SPD. RESULTS
C
          SPDMAJ=0
          IF(SPDVOT(1).EQ.SPDVOT(2))SPDMAJ=SPDVOT(1)
          IF(SPDVOT(1).EQ.SPDVOT(3))SPDMAJ=SPDVOT(1)
          IF(SPDVOT(2).EQ.SPDVOT(3))SPDMAJ=SPDVOT(2)
C
C
C AFTER COMPLETING PRIMARY VTLU - DETERMINE FINAL DECISION USING SECONDARY VTLU
C WITH WEIGHTINGS - BY MAJORITY RULE
C SET COUNTERS TO ZERO
C
C
          DRIV=0
          CNTR=0
          PASS=0
C
C DETERMINE VOTE CONTAINED IN OCCMAJ AND INCREMENT APPROPRIATE COUNTER BY OCWT (TO ACCOUNT FOR WEIGHTING)
C
          IF(OCCMAJ.EQ.1)DRIV=DRIV+OCWT
          IF(OCCMAJ.EQ.2)CNTR=CNTR+OCWT
          IF(OCCMAJ.EQ.3)PASS=PASS+OCWT
C
C REPEAT WITH VOL. AND SPEED
C
          IF(VOLMAJ.EQ.1)DRIV=DRIV+VLWT
          IF(VOLMAJ.EQ.2)CNTR=CNTR+VLWT
          IF(VOLMAJ.EQ.3)PASS=PASS+VLWT
C
          IF(SPDMAJ.EQ.1)DRIV=DRIV+SPWT
          IF(SPDMAJ.EQ.2)CNTR=CNTR+SPWT
          IF(SPDMAJ.EQ.3)PASS=PASS+SPWT
C
C COMPARE TOTALS - SET RESULT IN INCLAN TO LANE WITH MOST VOTES
C
          IF(DRIV.GT.CNTR)GOTO 70
            IF(CNTR.GT.PASS)GOTO 72;                          CENTER LANE INCIDENT
  70          IF(DRIV.GT.PASS)GOTO 71;                        DRIVING LANE INCIDENT
                INCLAN=3;                                     PASSING LANE INCIDENT
    .           GO TO 75
C
  71          INCLAN=1;  INC. IN DRIVING LANE
              GO TO 75
C
  72        INCLAN=2;    INC. IN CENTER LANE
C
C
C ONCE A DECISION IS REACHED, WRITE LANE OF INCIDENT INTO RECORD OF "INCLOG"
C                             FOR THAT INCIDENT
C
C
C
  75      CALL OPEN(3,'INCLOG',2,IER,2*25)
          CALL READR(3,INCREC(STN),INCLOG(1),1,IER)
          INCLOG(5)=INCLAN
          CALL WRITR(3,INCREC(STN),INCLOG(1),1,IER)
          CALL CLOSE(3,IER)
C
C
C CREATE ARRAY 'RESDV' AND WRITE INTO DISK FILE
C
C
C
          RESDV(1)=MDY(3)
          RESDV(2)=MDY(1)
          RESDV(3)=MDY(2)
          RESDV(4)=HMS(1)
          RESDV(5)=HMS(2)-1
          RESDV(6)=HMS(3)
          IF(RESDV(5).GE.0)GOTO 80
            RESDV(4)=RESDV(4)-1
            RESDV(5)=59
  80      RESDV(7)=STN
          RESDV(8)=INCLAN
          RESDV(9)=INCOT
          RESDV(10)=INCVT
          RESDV(11)=INCST
          RESDV(12)=OCWT
          RESDV(13)=VLWT
          RESDV(14)=SPWT
          RESDV(18)=OCCMAJ
          RESDV(22)=VOLMAJ
          RESDV(26)=SPDMAJ
C
C
C
          CALL OPEN(3,'RESDEV',3,IER,2*26)
          CALL WRITR(3,RSDVR(STN),RESDV(1),1,IER)
          CALL CLOSE(3,IER)
C
  20      CONTINUE
        RETURN
        END
```

```
C
      OVERLAY OW00030
      SUBROUTINE W00030
C
      DIMENSION DATASM(448)
      DIMENSION SDVOL(46),SDOCC(46)
      DIMENSION DNVOL(67),UPVOL(67),DNOCC(67),UPOCC(67),LNSPD(67)
      DIMENSION LVCNT(67)
      DIMENSION CSOCC(22),PSOCC(22),SOCC1M(22),SVOL1M(22),CSVOL(22),
     *PSVOL(22),SSPD(22),LNSTS(22)
C
      COMMON/GEOM/STOT,DTOT,NRAMPS,NSTNS,CAP(22)
      COMMON/D30/DATA30(718)
      COMMON/DINDX/XREFTB(180),XREF(113)
C***
C***
C
C   THE VARIABLE 'SREC' IS  FOR TEST PURPOSES ONLY AND MUST BE REMOVED BEFORE
C   IMPLEMENTING THIS ROUTINE IN THE SYSTEM
C
C     COMMON/RCRD/SREC
C     INTEGER SREC,LOGRD30(768)
C***
C***
C
C
      INTEGER DATASM
      INTEGER SDVOL,SDOCC
      INTEGER DNVOL,UPVOL,DNOCC,UPOCC,LNSPD,LVCNT
      INTEGER CSOCC,PSOCC,SOCC1M,SVOL1M,CSVOL,PSVOL,SSPD,LNSTS
      INTEGER STOT,DTOT,NRAMPS,NSTNS,CAP
      INTEGER DATA30
      INTEGER XREFTB,XREF
      INTEGER DSTAT,DNSTAT,UPSTAT
      INTEGER NPOS,VOLSUM,OCCSUM,SPDSUM,NSP
      INTEGER I,K,J,I1,I2,IK,NLANE,NSTNM2,ISPD
C
      EQUIVALENCE (SDVOL(1),DATA30(49)),(SDOCC(1),DATA30(95)),
     *(DNVOL(1),DATA30(141)),(UPVOL(1),DATA30(208)),
     *(DNOCC(1),DATA30(275)),(UPOCC(1),DATA30(342)),
     *(LNSPD(1),DATA30(409)),(LVCNT(1),DATA30(476))
C
      EQUIVALENCE (CSOCC(1),DATA30(543)),(PSOCC(1),DATA30(565)),
     *(SOCC1M(1),DATA30(587)),(SVOL1M(1),DATA30(609)),
     *(CSVOL(1),DATA30(631)),(PSVOL(1),DATA30(653)),
     *(SSPD(1),DATA30(675)),(LNSTS(1),DATA30(697))
C
C  CHECK FOR MALFUNCTION IN SINGLE-LOOP DET DATA
C
      DO 200 I=1,STOT
      DSTAT=XREFTB(I)/1000 ;DET STATUS
      IF(DSTAT.EQ.0)GOTO 200 ;DET OK
      SDVOL(I)=-1 ;SET VOL=-1
      SDOCC(I)=-1 ;SET OCC=-1
 200  CONTINUE
C
C  CHECK FOR MALFUNCTION IN DBLE-LOOP DET DATA
C
      DO 300 I=1,DTOT
      K=I+STOT
      DNSTAT=XREFTB(K)/1000 ;DET STATUS
      UPSTAT=XREFTB(K+DTOT)/1000
      IF(DNSTAT.EQ.0.AND.UPSTAT.EQ.0)GOTO 300 ;BOTH OK
      IF(DNSTAT.EQ.UPSTAT)GOTO 340 ;BOTH NOT OK
      IF(DNSTAT.EQ.0)GOTO 350 ;DOWN OK BUT NOT UP.
      DNVOL(I)=UPVOL(I) ;USE UPSTR.VOL--UP OK BUT NOT DOWN
      DNOCC(I)=UPOCC(I) ;USE UPSTR. OCC
      GOTO 320
 340  DNVOL(I)=-1 ;SET DOWN VOL $ OCC=-1
      DNOCC(I)=-1
 350  UPVOL(I)=-1
      UPOCC(I)=-1 ;SET UP VOL $ OCC=-1
 320  LNSPD(I)=-1 ;SET LANE SPEED =-1
      LVCNT(I)=-1 ;SET LONG VEH COUNT=-1
 300  CONTINUE
C***
C***
C
C TEMPORARY ROUTINE TO OBTAIN USABLE DATA IN ABSENCE OF COLLECTING STATIONS
C
C     CALL OPEN(3,'RICK30',1,IER,2*64)
C     CALL RDRW(3,SREC,LOGRD30(1),12,IER)
C     IF(IER.NE.1)GOTO 51
C     DO 50 IELMT=1,475
C 50     DATA30(IELMT)=LOGRD30(IELMT)
```

```
C       SREC=SREC+12
C       CALL CLOSE(3,IER)
C       RETURN
C   51  IF(IER.EQ.9)TYPE "END OF FILE *RICK30*"
C       IF(IER.NE.9)TYPE "ERROR CODE: ",IER," RETURNED BY LIBRARY SUBROUTINE  RDRW"
C       CALL CLOSE(3,IER)
C***
C***
C
        RETURN
        END
```

```
;       QEWXEC - FORTRAN IV MULTI-TASKING TSCS
        .TITL CLOCK
; INTERRUPT SERVICE FOR USER CLOCK. IT ACTIVATES
; A TASK WHICH IS WAITING FOR A MESSAGE TO
; BE DEPOSITED IN A 1-WORD INTEGER VARIABLE
; CALLED "TIMER", IN LABELLED COMMON BLOCK "KLOCK".
;
        .ENT    CLOCK
        .EXTN   .IXMT,.UCEX
        .COMM   KLOCK,1
        .NREL
;
; REFER TO RDOS REFERENCE MANUAL, PG. 5-11, FOR .IXMT,
;    AND TO USER DEVICE DRIVER IMPLEMENTATION IN RDOS MANUAL, PG. 3-9, FOR .UCEX
;
CLOCK:  STA     3,TEMP3         ;SAVE AC3
        STA     2,TEMP2         ;SAVE AC2
        LDA     0,.MESS         ;YES,TIME TO CALL TASK
        SUBZR   1,1
        .IXMT                   ;WAKE UP TASK
        JMP     .+1             ;ERROR?
        SUBZR   1,1
        LDA     3,TEMP3         ;RESTORE AC3
        LDA     2,TEMP2         ;RESTORE AC2
        .UCEX                   ;EXIT
;
.MESS:  .GADD   KLOCK,0
TEMP2:  0
TEMP3:  0
;
        .END
```

```
;
; "ISIO" -- ISI/3M MODEL 300 INPUT/OUTPUT
;
; THIS HAS BEEN MODIFIED ON 81-07-20 BY ROBERT LIANG;
; THE REQUIRED MODIFICATIONS WERE DESIGNED BY DAVE DUNLOP.
;
; THIS IS AN ASSEMBLER LANGUAGE PACKAGE WHICH ALLOWS THE NOVA 4/X
; FORTRAN IV PROGRAMMER TO COMMUNICATE WITH THE ISI/3M MODEL 300
; NETWORK CONTROLLER IN AN MRDOS MULTI-TASKING ENVIRONMENT.
;
        .TITL   ISIO
        .ENT    IBDEF,IBRMV,BREAD,BWRIT
        .EXTN   .UIEX
        .EXTU
;
        .ZREL
.RD:    RDCDE
.WR:    WRCDE
;
        .NREL
;
; DEVICE CONTROL TABLE (DCT)
; --------------------------
;
        .DUSR   ISI=15                  ;ISI/300 DEVICE CODE DEF'N
ISDCT:  180+.+1                         ;ADDRESS OF ISI DCT
        ISSA                            ;INTERRUPT STATE SAVE AREA
        000477                          ;MASK OUT ALL SLOWER DEV & DISK
        ISINT                           ;INTERRUPT HANDLER
;
; ADDITIONAL STORAGE
; ------------------
;
ISSA:   .BLK    10                      ;STATE SAVE AREA
ISCDE:  ISI                             ;ISI/300 DEVICE CODE
ISMSG:  0                               ;MESSAGE ADDRESS
ISTAT:  .BLK    1                       ;I/O STATUS WORD
RDCDE:  10
WRCDE:  7
;
; INTERRUPT SERVICE ROUTINE
; -------------------------
ISINT:  NIOC    ISI                     ;DISMISS INTERRUPT
        STA     2,TMP1                  ;SAVE AC'S
        STA     3,TMP2
        SUBZL   1,1                     ;SET UP MESSAGE
        STA     1,ISMSG                 ;GET MESSAGE LOCATION
        SUBZL   1,1                     ;1=TASK RE-SCHEDULING
        LDA     2,TMP1                  ;RESTORE AC'S
        LDA     3,TMP2
        .UIEX
TMP1:   0
TMP2:   0
;
; "IBDEF" IS CALLED ONCE, TO DEFINE A NON-SYSGENED USER INTERRUPT
; DEVICE TO THE SYSTEM, BY PLACING AN ENTRY IN THE INTERRUPT VECTOR TABLE.
; FOR MORE DETAILS, REFER TO PG. 7-1 TO 7-2 OF THE RDOS REFERENCE MANUAL.
;
; CALLED BY
; ---------
;                       CALL IBDEF (IER)
; WHERE:
;       IER = ERROR CODE (1=OK)
;
KER=    -167
        1
IBDEF:  JSR     @.CPYL
        SUB     0,0
        STA     0,ISTAT                 ;INITIALIZE STATUS
        LDA     0,ISCDE                 ;ISI DEVICE CODE
        LDA     1,ISDCT                 ;DCT ADDRESS
        LDA     2,C3                    ;# OF 1K BLOCKS FOR MAP
        .SYSTM
        .IDEF                           ;INTERRUPT DEFINE
        JMP     IBD20                   ;ERROR RETURN
        LDA     2,D2                    ;OK RETURN CODE
IBD20:  INC     2,2                     ;CONVERT RDOS CODE
        INC     2,2                     ;   INTO
        INC     2,2                     ;FORTRAN ERROR CODE
        STA     2,@KER,3                ;STUFF RETURN CODE
        JSR     @.FRET                  ;EXIT
C3:     3
D1:     -1
D2:     -2
;
```

```
;
; "IBRMV" IS CALLED ONCE. TO REMOVE THE ENTRY OF A NON-SYSGENED
; USER INTERRUPT DEVICE FROM THE SYSTEM'S INTERRUPT VECTOR TABLE.
; FOR MORE DETAILS. REFER TO PG. 7-3 OF THE RDOS REFERENCE MANUAL.
;
; CALLED BY
; ---------
;                 CALL IBRMV (IER)
; WHERE:
;       IER = ERROR CODE (1=OK)
;
KER=    -167
        1
IBRMV:  JSR     @.CPYL
        LDA     0.ISCDE             ;ISI DEVICE CODE
        .SYSTM
        .IRMV                       ;INTERRUPT REMOVE
        JMP     IBD40               ;ERROR RETURN
        LDA     2.D2                ;OK RETURN CODE
IBD40:  INC     2.2                 ;CONVERT RDOS CODE
        INC     2.2                 ;   INTO
        INC     2.2                 ;FORTRAN ERROR CODE
        STA     2.@KER.3            ;STUFF RETURN CODE
        JSR     @.FRET
;
; "BREAD" IS CALLED FROM A FORTRAN TASK TO READ THE ISI 300. THE
; TASK IS SUSPENDED UNTIL THE I/O IS COMPLETE.
; FOR MORE DETAILS. REFER TO PG. 7-3 OF THE RDOS REFERENCE MANUAL.
;
; CALLED BY
; ---------
;                 CALL BREAD (IBUFF(1).LGTH.IER)
; WHERE:
;       IBUFF = INPUT BUFFER ADDRESS
;       LGTH  = NUMBER OF WORDS TO BE READ
;       IER   = STATUS CODE RETURNED TO CALLER
;
IBUFF=  -167
LGTH=   -166
IER=    -165
MKEY=   -164
VALUE=  -163
        5
BREAD:  JSR     @.CPYL
        LDA     0.ISTAT             ;GET DEVICE STATUS
        MOV     0.0.SZR             ;CHECK IT
        JMP     IBD90               ;ERROR - I/O IN PROGRESS
        LDA     0.@.RD              ;SET INPUT STATUS
IBD50:  STA     0.ISTAT             ;SAVE STATUS
        LDA     0.ISCDE
        LDA     1.IBUFF.3           ;GET USER BUFFER ADDRESS
        .SYSTM
        .STMAP
        JMP     IBD99
        MOV     1.0
        DOAS    0.ISI               ;LOAD DEVICE ADDRESS CER
        LDA     0.@LGTH.3           ;GET WORD COUNT
        NEG     0.0                 ;2 -S COMPLEMENT
        DOB     0.ISI               ;LOAD DEVICE WORD COUNTER
        SUB     0.0                 ;CLEAR AC0
        STA     0.ISMSG
        LDA     0.ISTAT
        DOCP    0.ISI               ;START I/O
LP:     LDA     0.ISMSG
        MOV     0.0.SNR
        JMP     LP
        LDA     2.D2                ;I/O COMPLETE
        JMP     IBD99
IBD90:  LDA     2.D1                ;SET ERROR CODE
IBD99:  INC     2.2                 ;CONVERT RDOS CODE
        INC     2.2                 ;   INTO
        INC     2.2                 ;FORTRAN ERROR CODE
        STA     2.@IER.3            ;STUFF RETURN CODE
        SUB     0.0                 ;RESET STATUS
        STA     0.ISTAT
        JSR     @.FRET              ;RETURN
SAVE:   0
;
; "BWRIT" IS CALLED FROM A FORTRAN TASK TO WRITE TO THE ISI 300.
; THE TASK IS SUSPENDED UNTIL THE I/O IS COMPLETE.
;
; CALLED BY
; ---------
;                 CALL BWRIT (IBUFF(1).LGTH.IER)
; WHERE:
```

```
;       IBUFF = OUTPUT BUFFER ADDRESS
;       LGTH  = NUMBER OF WORDS TO BE WRITTEN
;       IER   = STATUS CODE RETURNED TO CALLER
;
        5
BWRIT:  JSR     @.CPYL
        LDA     0,ISTAT         ;CHECK DEVICE STATUS
        MOV     0,0,SZR
        JMP     IBD90           ;ERROR - GO RETURN
        LDA     0,@.WR          ;SET OUTPUT STATUS
        JMP     IBD50           ;GO PROCESS
;
        .END
```

```
DELETE QEW.LM
RLDR/P  QEW QEWBLK COMCOM DATAIN RAMCON MODM1 SLCHEK DLCHEK NXFER ^
  TRANSF [INITIALIZE,HEADING,WOOD30,UPD30S,INCDET, ^
    PERCHK,DATSTR,CLDU,VTLU,RCTIME,QUOCC,ALM30S,ALM5M, ^
    AMODM,DIS1,DYS1,DIS2] ^
  TOPCOM [INPEDIT,T12A,T12B,T13,T14A,T14B,T14C,T14D,T15, ^
    T16A,T16B,T16C,T16D,T17A,T17B,T18A,T18B,T18C,T18D]  ^
  GMAP [QSPD,QOCC,REQEW,CHQOR,ACCIDENT,DISMAP,RDISMAP,FLASH,FACC,LOOP, ^
    IOC1,IOC2,SPD1,SPD2,RAMPS,DETECTOR,BOX1,BOX2,BOX3] ^
  CORCAS ^
  CLOCK ISIO  ^
  <FMT FORT>.LB ^
  20/C 5/K  ^
  QEW.LM/L
```

```
OE4.SV  LOADED BY RLDR REV 07.10 AT 15:44:01 11/21/83
 .MAIN    000566
 .MAIN    000750
 COMCO    013033
 DATAI    014712
 RAMCO    017443
 MODM1    022165
 SLCHE    023411
 DLCHE    023664
 NXFER    024471
 TRANS    025617
 .       026572
         000.000  INITI      026572
LABELED COMMON IN NODE DEFINED OUTSIDE NODE   SCREE     001275 000004
001241
         000.001  HEADI      026572 000733
         000.002  WOOD3      026572 000473
         000.003  UPD30      026572 002344
         000.004  INCDE      026572 001451
         000.005  PERCH      026572 001560
         000.006  DATST      026572 001047
         000.007  CLDU       026572 002414
         000.010  VTLU       026572 002670
         000.011  RCTIM      026572 002045
         000.012  QUOCC      026572 002221
         000.013  ALM30      026572 002323
         000.014  ALMSM      026572 003374
         000.015  AMODM      026572 001303
         000.016  DIS1       026572 001442
         000.017  DYS1       026572 001422
         000.020  DIS2       026572 002113
         032172
  TOPCO     032172
         034001
         001.000  INPED      034001 001433
         001.001  T12A       034001 001301
         001.002  T12B       034001 000762
         001.003  T13        034001 001621
         001.004  T14A       034001 001410
         001.005  T14B       034001 001776
         001.006  T14C       034001 001064
         001.007  T14D       034001 001401
         001.010  T15        034001 000401
         001.011  T16A       034001 001637
         001.012  T16B       034001 001765
         001.013  T16C       034001 001705
         001.014  T16D       034001 001647
         001.015  T17A       034001 001772
         001.016  T17B       034001 001366
         001.017  T18A       034001 001644
         001.020  T18B       034001 001325
         001.021  T18C       034001 000716
         001.022  T18D       034001 001512
         036001
  GMAP      036001
         040166
         002.000  QSPD       040166 000631
         002.001  QOCC       040166 000444
         002.002  HEQEW      040166 000077
         002.003  CHQOR      040166 000254
         002.004  ACCID      040166 000131
         002.005  DISMA      040166 000626
         002.006  RDISM      040166 000602
         002.007  FLASH      040166 001270
         002.010  FACC       040166 000126
         002.011  LOOP       040166 000327
         002.012  IOC1       040166 001166
         002.013  IOC2       040166 000432
         002.014  SPD1       040166 001162
         002.015  SPD2       040166 001143
         002.016  RAMPS      040166 001067
         002.017  DETEC      040166 000264
         002.020  BOX1       040166 000274
         002.021  BOX2       040166 000575
         002.022  BOX3       040166 000464
         041566
  CORCA     041566
  CLOCK     041602
  ISIO      041617
  MTI       041764
  ITASK     042653
  FPRI      042700
  FXMT      042706
  MOVLD     042737
  MOVRL     042755
```

```
ABORT     042767
STTSK     042776
FCNS      043005
RUCLK     043021
DUCLK     043027
FSPOL     043037
WAIT      043067
TIME      043151
DATE      043163
FREAD     043200
THREA     047357
RDFLD     047423
READL     047533
OFTAB     050006
READR     050111
FFILE     050165
OPEN      050244
OFILW     050527
CFILW     050552
CLOSE     050615
IOPRE     050667
ITEST     050705
BSTRI     050756
FREDI     051033
FALOC     051137
ARYSZ     051157
FSBR      051175
CGT       051372
MOD       051416
SMPY      051427
SDVD      051453
MNMXD     051521
IPWER     051565
AFRTN     051640
MVBT      051645
LDO       051704
STOP      051723
ISARE     051747
FLINK     051762
WTER      052126
WRCH      052341
BDASC     052356
BASC      052437
COUT      052473
LDSTB     052516
CPYAR     052546
MAD       052610
FARGO     052633
ARGUM     052666
FPZER     052736
DUMMY     052736
ARDUM     052736
MMPYD     052737
TOVLY     052750
IXMT      053214
TXMT      053214
TIDC      053351
TPRI      053511
MTUMO     053534
TSVRS     053564
SMTSK     053712
KILAD     053725
MICOM     053725
BSAC3     054377
DUMMY     054377

   NMAX      054406
   ZMAX      000217
   CSZE      000000
    EST      000000
    SST      000000

   LPN.X     000000
   ESV.Z     000007
   .FREA     000052
   .FWRI     000053
   .BRD      000054
   .BWR      000055
   .ALLO     000075
   .THRE     000076
   .RDFL     000077
   .RDFC     000100
   .WRIT     000101
   .READ     000102
```

APPENDIX 37/ DMATST Source Program Listing

```
C
C       PROGRAM DMATST
C
C
C       RUN THIS PROGRAM WITH THE HP 21MX DMA DIAGNOSTIC
C         PROGRAM (CHAPTER 8 OF MTC CABLE NETWORK SPEC)
C
C       TO LOAD THIS PROGRAM, TYPE
C         RLDR/P DMATST ISIO FORT.LB
C
        INTEGER BUF(545)                        ;BUFFER
        INTEGER I                               ;INDEX
        INTEGER IER                             ;ERROR CODE: 1=OK
        INTEGER PROTCL                          ;PROTOCOL
C
C
C       DEFINE HP 21MX TO SYSTEM
C
        CALL IBDEF (IER)
        IF (IER .NE. 1) TYPE "IBDEF IER =", IER
C
C       PROMPT USER FOR PROTOCOL
C
10      CONTINUE
        TYPE "
        ACCEPT "TYPE 0 (STOP) OR PROTOCOL 1 (READ) OR 2 (WRITE)>", PROTC
        IF (PROTCL .EQ. 0) GO TO 900
        IF (PROTCL .EQ. 1) GO TO 100
        IF (PROTCL .EQ. 2) GO TO 200
        GO TO 10
C
C       PROTOCOL 1: READ FROM HP 21MX
C
100     CONTINUE
        BUF(1)=1
        BUF(2)=545
        CALL BWRIT (BUF(1), 2, IER)
        CALL BREAD (BUF(1), 2, IER)
C
        CALL BREAD (BUF(1), 545, IER)
        IF (IER .NE. 1) TYPE "BREAD IER =", IER
        WRITE (10, 105) PROTCL, (BUF(I), I=1,545)
105     FORMAT (' PROTOCOL ', I1, ':' / (15 (1X, I6, 1X)) )
        GO TO 10
C
C       PROTOCOL 2: WRITE TO HP 21MX
C
200     CONTINUE
        BUF(1)=2
        BUF(2)=8
        CALL BWRIT (BUF(1), 2, IER)
        CALL BREAD (BUF(1), 2, IER)
C
        BUF(1)=000010K
        BUF(2)=000014K
        BUF(3)=000024K
        BUF(4)=000030K
        BUF(5)=000040K
        BUF(6)=000050K
        BUF(7)=000060K
        BUF(8)=000104K
        WRITE (10, 205) PROTCL,(BUF(I), I=1,8)
205     FORMAT (' PROTOCOL ', I1, ':' / 8 (1X, O6, 'K'))
        CALL BWRIT (BUF(1), 8, IER)
        IF (IER .NE. 1) TYPE "BWRIT IER =", IER
        GO TO 10
C
C       REMOVE HP 21MX FROM SYSTEM
C
900     CONTINUE
        CALL IBRMV (IER)
        IF (IER .NE. 1) TYPE "IBRMV IER =", IER
C
C       END OF ROUTINE
C
        STOP
        END
```

POOR

QUALITY

ORIGINAL